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ELECTRICAL REVIEW.

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We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

GOVERNMENT REORGANISATION OF ELECTRICITY SUPPLY IN GERMANY.

THE latest scheme of special importance reported from Germany relates to the preparation of Bills for the consideration of the Legislative Chamber for the purpose of regulating the supply of energy throughout the country. The question of nationalising the supply of electricity was discussed on various occasions prior to the war, but it was only during the course of actual hostilities that an official announcement was made, as we mentioned some months ago, that the Government of the day had no intention of proceeding to expropriate the electricity works in Germany. In the meantime, the Revolution has wrought many changes in that country, but it has not effected any alteration under the so-called new *régime* in the determination not to transfer electricity works to the State. The present great scheme aims at the establishment of a uniform organisation for the utilisation of the sources of energy contained in coal, peat, mineral oil, and water-falls, and the distribution of the energy in a more economical manner than the present for the benefit of the whole community. The project is due to the initiative of the war-time creation known as the "Imperial" Economic Board, which was formed to deal with practically all economic matters, and the words "Imperial" and "Empire" are still continued, because the Germans are reluctant, perhaps for ulterior reasons, to abandon them. Indeed, when we read that the Bills have been forwarded to the Federal States—representatives of which constituted the formerly all-mighty Federal Council with which the Kaiser and the industrialists controlled Germany—particularly Prussia, Saxony, and Bavaria as being chiefly concerned, and that after hearing their views the Bills will be submitted to the new Parliament, it looks as if the old Germany still exists, and, leopard-like, finds it impossible to change her spots.

The Bills undoubtedly have a two-fold object. In the first place, it is hoped to rehabilitate the country commercially and financially by effecting considerable economies in the production and distribution of energy for the welfare of the whole empire, and thus avoid the enormous waste of energy which has been in progress, stimulated by the electrical manufacturing firms in their aims for securing a multiplicity of connections and business. The second object, which is not less important, is to offer a substitute for the wild schemes of nationalisation or socialisation which have become prevalent in Rhenish Westphalia, particularly in the coal mining industry, and in this way divert the minds of the turbulent section of the population, if possible, from the destructive tactics which are being followed in the matter of industrial works, some of which have been seized by the workmen and continued in their own interests. It is recognised, at least by the Imperial Economic Board, that the appointment of a Nationalisation Commission by the late Government was a mistake, inasmuch

as it has resulted in great harm to the country, and has probably prompted the mad socialisation schemes which have been carried out in individual cases in the West. The action in this direction has merely changed one producer for another, and capital in bulk for individual capital, and placed in possession men who are inferior technically to the rightful owners, and who lack commercial experience, but who in their efforts to gain profits are considerably more regardless of general interests than the actual or former proprietors. This state of affairs is leading to the ruin of industries, and rendering impossible any competition in international markets.

The consumption of electricity throughout Germany increased five-fold between 1907 and 1917, whilst it has risen ten-fold in the case of the public supply works taken separately in the same period of years. The rapidity of the development was such that, in the words of the Economic Board, the Government neglected to take advantage of the appropriate moment for intervening in the industry and obtaining influence and the power of jointly determining matters. As a consequence, the disadvantages have arisen that works have been scattered all over the country in a completely unsystematic manner; private monopolies have been created on the one hand and communal one-sidedness on the other—each small community, through ambition or envy, striving to have its own electricity works; and a preferential supply has been given to profitable districts, whilst the others have been neglected. Under these circumstances, it is scarcely surprising to learn that there are over 4,000 separately-owned supply undertakings throughout the country, and this large number is said to represent an enormous waste of energy, whereas 100 large works would be able to satisfy the entire needs of the country. The Bill, therefore, proposes to advance the interests of the sound undertakings which already exist, and systematically to abandon the uneconomical works, which can no longer be permitted to cause such a large waste of energy. It is intended to divide the empire for the purpose of electricity supply, not according to political boundaries, but into supply districts organically limited according to technical and economic interests; and the supply works in these districts will be formed into a combination, and will no longer compete with each other, but will co-operate in satisfying the demands of consumers. The combinations or groups thus formed will be constituted by the State, although it is proposed to leave scope within the combinations for free initiative and strong personality, subject always to the welfare of the State. It is hoped in this way to secure the maximum efficiency in the production and utilisation of electrical energy. The question of water power is to be dealt with in a further Bill, which has yet to be prepared. The Government contemplates the creation of Departments to establish the previously mentioned combinations, in which the interests of consumers and of the skilled workmen will be represented; wages questions will be jointly settled by the employers and the workmen; and the whole of the industry will be supervised by the Imperial Economic Board, assisted by a Council formed of interested parties.

The details of the coal and electricity Bills have not yet been published. Sufficient has been stated, however, to show the general trend of the projected legislation. The idea of State control of the supply industry from a comparatively small number of huge generating stations is not new in itself. It was proposed for Germany, as our readers will remember, by Herr Klingenberg some time ago; and the big-station scheme was also suggested for London by the same engineer at an earlier date in a paper read before the Institution of Electrical Engineers. But that was before *we* expected the Zeppelins; perhaps not before Herr Klingenberg anticipated their paying us a visit. On the other hand, another German authority states that the scheme "breathes the spirit of Rathenau," and consequently it is regarded with the greatest distrust; and with this quotation we will leave the subject for the present.

Lighting Problems.

Now that the lighting restrictions are removed, there is only the question of rationing to be lifted before the shops are at liberty to revert to their former conditions of lighting. But the question is, will they, and ought they, to be once again *in statu quo ante bellum?* It will be remembered that for some time before the war outside shop lighting had threatened in some parts to become a public nuisance. Flame arc lamps had become the order of the day or night, and certain classes of tradesmen had emulated each other in trying to get the greatest number of arc lamps over the smallest area. In some of the streets in London (for instance, in some parts of the Strand) the glare of these outside lights had become an intolerable nuisance to the passing public. If we remember rightly, there was a movement in progress to impose stringent regulations with regard to outside lighting, so as to safeguard the comfort of the ordinary pedestrian. The coming of war, of course, cut it all short. The question now is: is the matter of lighting to be allowed to revert to its former lawless state? From the point of view of display of goods, and, in fact, every other point of view as well, the best form of illumination is obviously concealed lighting in which the sources of light are altogether outside the range of vision, and the goods in the shop window *only* are illuminated. The increased efficiency of metallic-filament lamps ought to make this form of lighting more popular than ever. There is an opening here for the Illuminating Engineers' Society to make good its *rôle* of leadership in the science of illumination, and to guide the fashion of lighting into proper channels. What better opportunity could be afforded than the present, when people are accustomed to very moderate lighting, and when there would therefore be no opposition from the public to any restrictions that were made for the public good?

The Salaries of Technical Staffs.

We noted with interest that the *Electrician*, in its last issue, drew attention to the low salaries offered to the technical staffs of engineering colleges in recent advertisements, and we have pleasure in supporting the protest of our contemporary against this short-sighted policy. Instances are quoted in which technical assistants are offered £150 to £175 per annum, and for the head of the electrical engineering department of a Municipal Technical College the salary named was £300 per annum.

That scientific training is an essential part of the development of an engineer in any branch of the profession is known nowadays even to the layman; but what sort of instruction can be obtained for the wages of an unskilled labourer? The salaries paid to technical teachers have never erred on the side of generosity, even in peace time—but apparently the managers of our educational institutions think that the same old rates can be maintained even in these days, when the sovereign is worth only ten shillings. It may be argued that plenty of candidates will be found willing to accept these rates, for the sake of the opportunities of technical study that such posts afford; but what a ghastly mistake it is to enroll men as teachers who themselves are in need of instruction! It is emphatically not a business proposition; as our *confrère* suggests, it is more or less of a fraud upon the students, and it is very certain that the nation will pay dearly in the future for niggardly economies of this kind in the present.

LARGE ROLLING MILL PLANT.

Messrs. Siemens Brothers Dynamo Works, Ltd., have completed recently at their works at Stafford the first of two reversing mill motors having a peak power of 19,000 h.p. This motor has just passed successfully through its tests at the works, and we give herewith some particulars and illustrations of the machine.

The motor has been built to drive a 36-in. roughing and finishing mill on the North-East Coast, and there is now in course of construction a second motor of similar size and type to drive a 34-in. roughing and finishing mill in the Sheffield district.

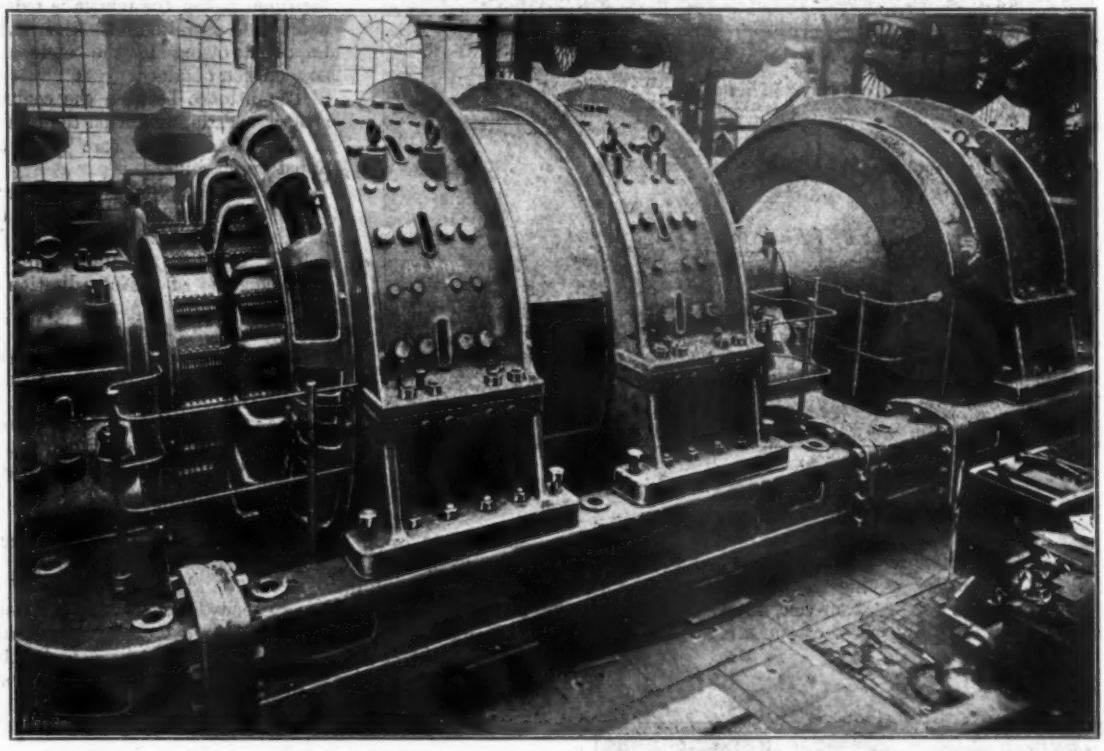

Fig. 1.—A Siemens 19,000-h p. Rolling-Mill Motor.

The motor just completed is shown in fig. 1. It will be seen that it comprises three units rigidly coupled together and mounted on a combined bedplate. The advantages derived from this design are referred to later.

The total of 19,000 peak-load h.p. is obtained at speeds ± 60 to 140 r.p.m. The pressure across the armatures is 1,400 volts, and the weight of the complete machine is approximately 300 tons. The diameter of the shaft in bearings is 24 in., and that of the shaft extension 27 in.

Figs. 2 and 3 are interesting as illustrating the machine in course of manufacture and erection on the test bed; fig. 2 shows two of the three armatures in position, and the coupling for connecting the third armature. Between the two armatures is seen the special coupling piece for connecting them together; this coupling registers the two spiders and provides for a drive in either direction through special keys. This illustration also shows the double commutator which is a special feature in the design of these motors.

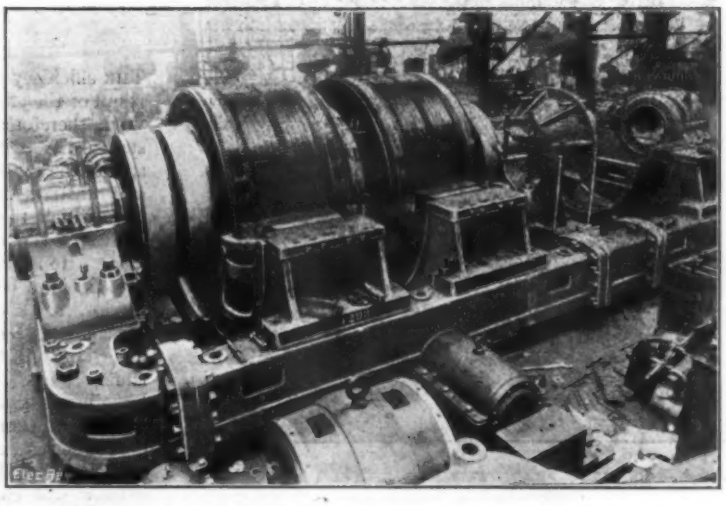

Fig. 2.—Two of the Three Armatures, Showing the Coupling.

In fig. 3 is seen one of the armatures with the core plates built up, but before the armature windings have been fitted. This illustration shows the central air gap and end plates which have been specially designed for providing ample ventilation. The cast-steel spider fitted with driving bosses at the periphery is also shown.

Each armature is provided with its own shaft, the drive, as explained above, being transmitted through the spiders of the armatures. Thus great rigidity is secured, and deflection between centres is thereby reduced to a minimum.

The completed frame with commutation poles and compensating windings is shown in fig. 4. The gap in the centre of the main pole-piece, which corresponds with a

similar gap in the armature, is a special and notable feature. The gap acts as a passage-way for the forced-draught ventilation, and provides an efficient means of cooling at the centre of the compensating-winding bars. The frame itself is constructed of cast-steel.

The drive is on the well-known "Ilgner" principle, the power supply being converted by means of a separate motor-generator set fitted with a heavy flywheel. This set consists of a three-phase driving motor, having a continuous rating of 3,750 H.P. on a 2,750-volt, 40-cycle, three-phase circuit, and running at a speed of 400 R.P.M. This motor is direct-coupled to, and mounted on, the same bedplate, with two variable-pressure generators mounted one on each side of the flywheel, and capable of supplying the necessary power to the mill motor. The flywheel is of cast-steel, and of the built-up type. It weighs 40 tons, and has a diameter of 15 ft.

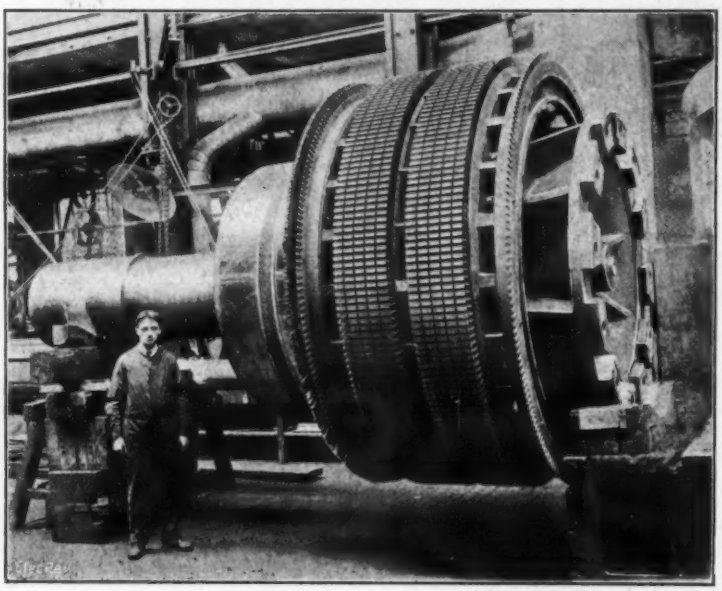

Fig. 3.—Armature with Core Plates, but without Winding.

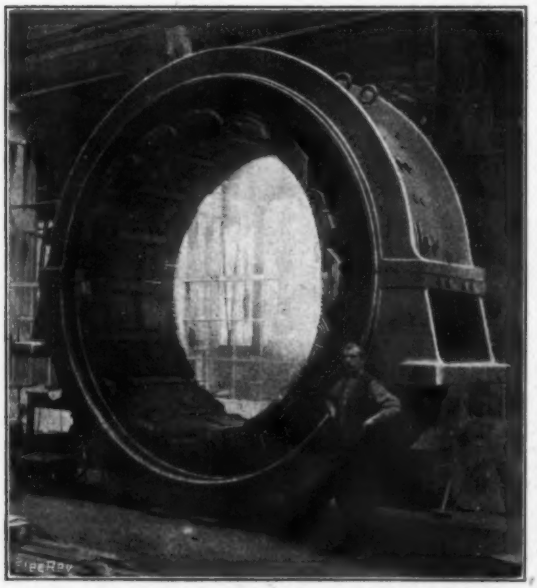

Fig. 4.—Complete Frame with Commutation Poles and Compensating Windings.

As the mill is entirely controlled by varying the fields of the exciters supplying respectively the fields of the variable-pressure generators and the mill motor, the main controller is of small dimensions.

The manufacturers claim that in dealing with such a high-powered motor the three-armature design possesses advantages over a double-armature machine of necessarily greater dimensions. These advantages are summarised as follows:—

As the diameter of the armatures is smaller than would be necessary in the case of a double-armature machine of the same power, the inertia is reduced, and the operation of the mill is improved owing to the more rapid acceleration obtained.

The distance between the centres is shorter, and the weight on the bearings is less than in the case of a two-armature machine.

The total weight of the motor is divided into less weighty parts, thus facilitating handling, &c.

This type of machine fulfils the requirements of standardisation of parts, as it is apparent that, by employing one, two, or three of the separate units composing the whole motor, either 6,500, 13,000, or 19,000 H.P. at 60 R.P.M. is available. It follows, therefore, that with motors made up of one, two, or more units, each unit of uniform design and of uniform size and power, almost any size of mill can be driven, and the spare parts being all of standard pattern, the number of these to be kept available is reduced to a minimum.

The whole equipment follows closely the lines of the plant supplied by Messrs. Siemens Brothers Dynamo Works, Ltd., for electric winding in large collieries. In addition to the two 19,000-H.P. machines, Messrs. Siemens Brothers have in course of construction at Stafford two others of 12,000 H.P. and 6,400 H.P. respectively.

(To be concluded.)

THE DETERMINATION OF STANDARDS.

By Major E. A. PELLS, R.E.

The efficiency of any job is the relation between the actual result of the job and the standard; the value of all efficiency work, therefore, depends upon the accuracy with which the standard is arrived at in the first instance. Standards constitute the foundation upon which all efficiency work rests; and until definite standards are set, there exists nothing from which the degree of efficiency can be measured. To arrive at the standard for any job, time studies must be made. It is a matter of debate as to who was the originator of this idea, but the palm is usually given to F. Winslow Taylor, as his papers before the American Society of Mechanical Engineers were the first published matter describing the system. It is useless, however, to begin time studies before the lay-out and routing has been brought as near to perfection as possible, unless for the purpose of comparison. Therefore, the first thing to be done when it is decided to determine a standard for any particular job is to make a sketch of the lay-out and routing, and carefully consider it with a view to improvement. If alterations are made, a short period should be allowed to elapse to enable the workers to fall into the improved methods of working, before studies are made. This time may be utilised very usefully in preparing instruction cards for the operations performed, and to assist in this, long-time studies may be made.

A long-time study may be of a whole working day or of any other working period, and observers should get all the

details possible regarding the job observed, noted down, also all waste time, especially those few minutes which creep in, which are often regarded as rest periods and not taken into account. It is obvious that if this is not done, the efficiency engineer will get a false appreciation of the time values, and there will be, when short-time studies are made and the standard time is being determined, a lot of time which cannot be accounted for. Efficient observers are not made in a day or two, and it is far better to get down too much detail of the work in hand than not enough.

Short-time studies may now be made, and this should always be done on the best operative available, although it is just as well to let the worker know that his actual times will not be the standard times, as this prevents misunderstanding and usually leads to better results. My own method is also to time an average worker or two, as the results obtained are often of great assistance as to the real value of the best operative's times. The time data having been carefully collated and analysed, it is necessary to eliminate all actual waste time shown, as this is usually an irregular factor dependent directly upon the supervision. The rest factor is then added; this varies in ratio to the fatigue of the job, and may be anything from 12 per cent. to 50 per cent., but is usually somewhere about 20 per cent. Any other factors directly dependent upon the job under consideration are now brought in, and the standard can be fixed; should there be the slightest likelihood of immediate improvements, it would, perhaps, be advisable to describe it as an "experimental standard."

In considering factors for the determination of standards, good results can only be obtained by long and careful investigation. Accurate time study is most important, and cannot be hurried through.

Finally, no progress has ever been made in this world by people who are perfectly satisfied. There must be definite ideals at which we aim, and in efficiency methods these are provided by carefully compiled and calculated standards.

PLANNING A WORKS RESEARCH ORGANISATION.

At Birmingham, on February 5th, Mr. A. P. M. Fleming's paper (an abstract of which appeared in our issue of January 31st) was read and discussed before the South-Midland Centre of the Institution of Electrical Engineers.

Dr. C. C. Garrard said that a researcher should have his mind free from routine work and consideration of output in order that he might be able to concentrate entirely upon the particular researches in hand. A works laboratory was essentially a part of the production department; it was simply an organ of control for the use of the management. He was strongly of the opinion that the research department, if started, should not be an adjunct to the works laboratory. Scientific research should have the utmost publicity, so that all might benefit. A works' research department was established for commercial reasons, and it was unreasonable to expect the publicity which was necessary for a scientific research. The organisation of the development department must be different from those of the research department and works' laboratory; the former should be departmentalised, and would perform, among other duties, those mentioned under "Technical Processes" in the paper.

Dr. Kapp said it was natural to consider what universities and technical colleges could do to promote scientific research directed towards immediate use in industry. A research in electrical engineering carried out on a small scale might in many cases be misleading. It was simply a question of power at the works disposal. He needed only to mention the development of electric welding as applied in shipbuilding, where for spot welding a current of many thousands of amperes was required at something like 300 to 400 volts. The help a university could give to industry by way of research must be on the whole indirect. The training of men to work in laboratories would be the direction in which universities could be of real assistance to industry. In the case of small firms, laboratories of adequate size might be established on the principle of a trading company with the firms as shareholders. Any firm which was a member of the company could have its research done by the staff of the laboratory, the cost being charged to the firm ordering the research. By sharing valuable information among all the members of an industry the nation as a whole would benefit.

Mr. W. Wilson thought the need for research in the engineering industry of this country was most urgent, and the paper was especially welcome on this account. The inclusion of routine testing in the research organisation was unwise; this was an essential part of the works' cycle, and should be administered under the works manager. Industrial research itself was divisible into two grades, each of which should be treated separately, and be under separate management. Their functions were distinct; they required a different class of man to carry out the work; and many factories only required the lower grade (using the adjective as representing its position in the scheme), particularly to-day, when the products of their industrial establishments were becoming specialised. If progress and improvement were not desired in any respect, nothing further was needed in addition to the ordinary works routine testing. But as soon as the necessity was recognised for a continual advance in the direction of perfection, then a special department was required, which would be responsible for the developing of new ideas into "manufacturable" commodities, the solution of many of the problems that arose from time to time in the factory, the carrying out of such modifications as might be necessary in the patterns, types, or models of the product, and the making of experiments to determine what new departures and modifications were justified. The head of such a research department, which might be termed the "development" section, must be thoroughly versed in the actual products, as well as the methods and processes, of the particular shops dealing with them, and in addition with the use and performance of these products in the field.

Mr. H. V. Kramer thought that it was rather too premature to discuss details of building and plans of the laboratories, and he would like to see more thought given to the great principle which must govern this problem. Personally, he did not see how the erection of large laboratories would tangibly assist the needs of large mechanical and electrical manufacturing concerns, without some intermediate link being formed between the present works organisation and its facilities for design and production, and that of the laboratory. He would rather like to see, first of all, attention paid to the erection of a number of experimental workshops, complete with a well-equipped test room or small laboratory, specially equipped for the production of first constructions to make up specimens of new apparatus developed by each department of a large works, and so create a valuable addition to the present incomplete system existing in almost every large manufacturing establishment. With this experimental workshop and laboratory, a small research library and test-record intelligence department, should be connected, of, however, a purely specific value to the department. Then, and then only, the departmental manager of large works might be in a position to give tangible form to ideas from the staff of his department, or from the suggestions made to him by his clients or his salesmen, concerning the needs of the particular line in which he specialised. It would enable him to produce samples quite irrespective of and without interference with the regular routine productions for which the machinery of his particular department was laid down. In this way a clean cut would be established between the purely routine productive side of business, and the creative or research side for development. He was sure that a central laboratory of any of the types shown in the paper would not entirely be able to meet the variety of demands in this first and most important logical point, which was common to all works which were laid out for quantity production. He admitted, however, that in addition to the experimental workshops attached to every department, with or without small laboratory facilities, some scientific higher institution such as a central research laboratory, was essential.

At Manchester, on February 11th, Mr. A. P. M. Fleming delivered his lecture, which was followed by a discussion before the North-Western Centre of the I.E.E.

Dr. E. W. Marchant said that nearly all the large scale research work that was being carried on at the present time seemed to be done in America. If manufacturers did not take it up soon on a much larger scale they would ultimately feel the effects industrially in a very serious way. It was necessary to have a library if the laboratory was not to repeat work which had been done before. It was as essential as almost any other part of the institution—perhaps even more essential. Some people were capable of doing a particular kind of work much better than others, and an enormous saving could be effected if only the right people were chosen, but how far it was possible to carry that process it was difficult to say. If they were to get the very best type of person into research work it was necessary that the opportunities for advancement and the prospects held out for such work should be of an extremely generous kind. In the past the prospects in electrical engineering were not sufficiently good. The method of eliminating vibration of a table by india-rubber feet which rested on the top of two piers, worked extremely well; for a certain class of vibration it was excellent, but other methods would have to be adopted where the vibration was very severe. He welcomed the suggestion that it might be possible for the works to place facilities at the disposal of university students; that would be a tremendous step in advance.

Mr. B. Welbourne said that he thought a great deal about the necessity for having a central library in this country to

co-ordinate the whole of the published scientific literature of the world and make it available for engineers and scientists generally. He suggested that it would be a worthy war memorial to establish such an institution. The training of men by the universities was a fundamentally important question. The research worker was born, not made, and he thought the amount of really pure research work done in the works organisations would be very small; it would be left largely to the existing research worker, the pure scientist. Personally, he preferred to use some other phrase in place of "research. One could carry on industrial research under the heading of experimentation.

Dr. Miles Walker asked the author what he proposed to do with what might be called the "greater research." The researches that he spoke of certainly provided for such things as testing materials, and so on, but he believed they would not make much progress in the future unless they had research on big machines which must be done in the factory itself, and backed up by a board of directors prepared to spend a good deal of money in investigating what was the most useful line to go upon. In the next fifty years there would be changes in electrical engineering quite as great as those which had happened in the last forty years, and there would be entirely new types of machines performing entirely new functions for industrial purposes. If this country was to be in the forefront of manufacture it would have to do something in the way of developing, and those things could only be done by organised methods. Every large manufacturing concern ought to have a department whose business it was to see what kind of plant was likely to be required by manufacturers for all sorts of purposes, and see if there was anything that could be done better than it was done before. If this country was to stand forward as a progressive country, manufacturers must be prepared to expend some of their profits in experimenting on those lines. He protested most emphatically that research workers could be made. It ought to be possible to give everyone who had any spark of genius a suitable training so that he could be made into a research worker.

Mr. R. W. Bailey said the question of the supply of staff was the most important one that had to be tackled. The suggestion that works apprentices should pass through the sections of the research work other than routine testing was excellent; it gave an opportunity to select men whose educational record had been dealt with previously. He was strongly of opinion that a period in the workshop was essential before the post-graduate training was given.

Mr. J. S. Peck, who was connected with various committees dealing with research, said that very little progress was being made; most of the time was spent in disputing as to whether the income tax was going to be remitted on certain moneys which were subscribed by the different organisations. There seemed to be a great deal of talk and very little result. They had got to do something in the way of research, but it was a difficult matter to show that fine buildings and equipments were necessary. If there was a very big balance at the bank they could afford to make experiments, but most of the electrical manufacturers in this country were not in that position.

Mr. J. P. Bedson regretted that in this country the financial or the capital element of a business was too much under the control of the capitalist, and the intelligent expansion of a business could not always be secured. A paper like Mr. Fleming's should be read before the directorate or the financial men of large undertakings such as the Westinghouse. He hoped that the seeds were being sown in fertile soil. It was not on the technical side alone that education was needed; the financial side needed it as much.

Mr. A. Saxon thought that the author had made out a good case backed up by definite and well considered plans which were sufficiently flexible to meet most industrial requirements. All agreed that research work would pay. In view of the shorter working week (which seemed likely to be still further shortened) scientific research must come to the aid of the industry by the development of new processes, labour-saving appliances, and the selection of the most suitable materials so that an economical output might be obtained.

Principal Maxwell Garnett said there was room for close co-operation between the engineering industry and the colleges that were concerned with the training of engineers for research and management. Anything that increased that co-operation would increase the number and develop the qualities of the industrial research workers of the future. The Government research department was now prepared to make grants of £200 or £300 a year to a man who had to sacrifice an income exceeding that amount in order to go back for training in research work.

Mr. Lester thought it was very important to give a very large place to pure research work, even in industrial organisation. When routine work was introduced into the research laboratory, the research work that it was possible to do there was being limited. The same equipment might be used for both purposes, but there must be individuals whose first duty was to look after research, and who, if they did any routine testing at all, kept it in the second place. It would have to be a very big undertaking that could undertake to set up an adequate library for technical research; it was a better plan for laboratories to be placed within easy reach of suitable libraries. The question of salaries was very important. It was extremely difficult to get men who had the necessary brains and powers of observation, and when found they must be paid an adequate amount.

Mr. Strohmeyer said the establishments which had been described seemed to him to be very large for the works which they were supplying with information. If those institutions were to serve as cinder sifters they would require enormous staffs. A very large number of experiments had to be made with comparatively small results. The inventor had not been mentioned, but he should be part and parcel of those institutions. He believed that the universities objected to allowing any research work outside their own buildings to count as work for degrees. The National Physical Laboratory applied to the University of London to allow students to go to their laboratory, and that the work done there should count as post-graduate work, but it was said that it could not be done.

Mr. Chadwick said that one or two research institutions in America really did pay for themselves out of the sale of by-products produced during the investigations. That was quite independent of any help given to the works. If the Government had adopted a more liberal policy and provided more scholarships and grants they would have had a far greater supply of technically trained men.

Mr. Shipley complained that when a firm was notified about bad finish or workmanship, instead of the complaint being treated in a courteous way, the usual reply was that "the complaint was the first ever received in the history of the firm." He appreciated the necessity for a good library in the intelligence department. Owing to the lack of such libraries at Liverpool they had had to set up one for themselves. They had employed it not so much on research work as to help the engineers at their work.

Mr. Drummond Paton explained that one of the most successful institutions of this kind originated at Wigan about eight years ago. The scheme was brought before the directors, the Mining Board, and the university, but they could get none of them to realise the advantages of it. It was now in operation in the Mining School at Treforest. Such institutions were of small value if they were merely on a voluntary basis. Some driving power was necessary to make them national assets.

Mr. J. G. Pearce said there had been an unexpected unanimity in regard to the proposals for combining routine testing and research. One speaker suggested that such a policy was undesirable; that idea frequently rested on a misapprehension. It was thought by some that the research men would be continually interrupted in order to perform routine tests, but the proposal was exactly the reverse of that. The research men should be enabled to make use of the routine-testing department, and carry out the tests for which they had equipment and experienced staff. The economy of that procedure was obvious. This country was not so far behind as it might have been, because the whole of the research had been carried out in what they were pleased to call their routine testing laboratories.

Mr. Phillips did not agree that a central library or bureau was at all advisable. If intelligence departments were to be of any value at all they would have to be found in every town.

Mr. Fleming, in reply, said that they had undoubtedly done much more than one would be led to think by the lack of evidence. The Americans had taken hold of the research idea, and had spent money lavishly on it, and they had reaped their reward. He pleaded for the removal of research work from the manufacturing departments of the concern to laboratories where it could be done economically. Co-ordination of libraries was badly needed, and could, he thought, be arranged. With regard to the design and development of switchgear for dealing with large amounts of power, and of large machine work, it could not be expected to be done in a laboratory. A very important point was that when those machines were tested at the customers' premises it was most essential that they should be tested by qualified men to get the best results. The point that had been raised as to whether university students could carry out research satisfactorily in a works on account of not being able to use the work for degree purposes might apply in some cases, but it did not apply at Manchester, and he thought it did not hold good in certain other universities.

CARBON BRUSHES: CONSIDERED IN RELATION TO THE DESIGN AND OPERATION OF ELECTRICAL MACHINERY.

At Glasgow, on February 11th, Mr. P. Hunter-Brown's paper (an abstract of which appeared in our issue of December 27th, 1918) was read and discussed before the Scottish Centre of the Institution of Electrical Engineers.

Mr. Cowie agreed that it was desirable to have, say, three qualities of brushes to meet all cases, but he knew this could not be done. All the troubles did not come from the brushes, and he cited cases in support of this contention. One of the weakest parts of brushes was the method whereby the leads were fixed to the brush. Some machine manufacturers insisted on putting their own type of connections on to the

manufacturer's leads. This had resulted in confusion even when samples of replace parts were sent direct to the brush people, and in one case during the war almost shut down one of the biggest shipyards. Not enough attention was paid to the design of brush holders, first with regard to stiffness, and secondly, to getting the maximum wear out of the brush. He agreed that sub-divided brushes were much more satisfactory from the running point of view than one big block of material. At the same time it should be remembered that the machine manufacturer who did sub-divide was competing in an open market, and the extra parts meant loss of money so far as he was concerned. One of the finest brushes for slip-ring work was of the copper variety, but this would not run satisfactorily unless artificial lubrication was applied to the slip rings.

Mr. Inglis said that by grouping brushes in grades they could cut down the number of grades required. For turbo-generators he found that two grades were quite sufficient; for continuous-running motors for all speeds, three grades; and for reversing, D.C. motors, two grades. His experience had been that if they could not get sparkless commutation with those grades, the machine should be examined and put right. He invariably looked for trouble in the design of the machine, either electrically or mechanically. He disagreed with the author's system of bedding brushes. It was quite good practice to put on half the brushes at a time, allowing them to bed themselves down before the others were taken out. In the use of insulating material on the top of the brush he had found fibre to give trouble, especially in cases where there was a good rise in the temperature. They usually worked loose and fell out. If good heavy flexibles were fitted on properly he did not see that there was any necessity for insulating material. He advocated standardisation of brushes. There was no reason why the number of brushes should not be kept down to the minimum if manufacturers agreed to certain widths, depths, and thicknesses.

Mr. R. B. Mitchell also supported standardisation of brushes, remarking that where small motors were used one or two types of brushes could be employed almost invariably.

Mr. W. H. Flood said the present-day troubles were mainly due to the imperfect design of the brush-holders; each maker seemed to have his own pet idea, and they found quite opposite designs used on machines of the same output and speed and with commutators running at the same peripheral speed. He suggested the standardisation of armatures and proportions of commutators for all sizes of machines listed to run at standard speeds. This would materially assist in decreasing the number of types of brush. Personally he would like to see the number of grades reduced to about four, including a special grade for slip-ring use. The partial vacuum sometimes produced under a brush should, he thought, only appear in the laboratory, as in practice they did not find it possible to maintain such a fine degree of bedding and adjustment as to obtain this effect. The undercutting of mica had its advantages, but where a machine was running quite satisfactorily, he did not believe in undercutting because it was the fashion; but he found there was a tendency to-day to do so when an armature came in for repairs. The staggering of brushes was a very important point, but some makers of small machines did not leave sufficient commutator to satisfactorily carry this out. It was up to the designers to produce the correct form of brush-holder; he had during over 20 years' experience found the brush-holder very largely at fault.

Mr. Robertson said there was often trouble with pin type connections. The best type was the screw, but care had to be taken that the nut was not put in too tightly. They had types where flexibles were put on to a shoe and over the copper brushes. The only bad fault was that the flexibles were soldered to the shoe piece. He thought it the best plan to remove mica wherever possible, and if commutators were kept clean they gave no trouble. He favoured standardisation of brushes wherever possible.

Mr. A. Page trusted that there would be two developments from the work Mr. Brown had put into the paper: First, a higher degree of standardisation, and second, the abolition of the barbarous methods in vogue to-day with the men who had the upkeep of electrical machinery in their hands. He did not, of course, refer to places where skilled attention was available.

Mr. W. B. Hird objected to the manufacturer being saddled with the whole responsibility of standardisation. His firm had only one style of brush-holder and one size of brush in use for many years, except in extraordinary cases.

Mr. P. Hunter-Brown, in reply, referred to the committees already considering the question of standardisation. It had been rather difficult to reconcile the conflicting opinions on the subject. It would not be long before a standardised holder would be adopted by many firms. There would be more than one size, and the minimum would probably be two widths of brushes and three or four thicknesses to each width. There had been a tendency lately to abolish the use of the large brush. Graphite brushes could be successfully used on slip rings, but there they had to be careful, and not take the current density as the only guiding factor. As to lubrication, boiling in wax was sometimes effective, but they sometimes got a flood the first few days and a famine later. It was better to get a type of brush which possessed natural lubricating qualities.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Deliver!

There is a popular saying in the States, "We can deliver the goods." It has never attained much popularity in the electrical industry over here. Its terseness would have to be destroyed by the qualifying phrase, "if you wait long enough." When I was still at college, I once heard a customer say to a branch manager of —— that —— had only once been known to deliver an order on time, and then they sent the wrong apparatus. Instead of an indignant denial, the meek reply was that no other firm had done even that. At the time I thought this was mere badinage. Now I know it to be very near the sober truth.

Of course, manufacturers are badly handicapped at present, and are fighting against difficulties. New and unskilled men, labour troubles, lack of raw materials, influenza (oh! blessed word, how many delays has it covered?)—any buyer will know these excuses and others by the dozen. Each one, truly, has its weight. Each one has to be got over. Each one *can* be got over. There is, to my knowledge, one firm which can, and does, deliver in the time it promises, and that time is far less than its competitors dare dream of. (I do not belong to this firm, nor will I mention its name—that will probably be found on another page, inserted at the usual rates.) On a recent contract all the material except some switchgear could be obtained in eight weeks. For the switchgear three firms quoted; one asked 14/17 weeks, a second 10/12 weeks, the third, the one in question, 12/14 *days*. I knew from past experience that this delivery would be kept, whereas the other two firms were very uncertain, and would need constant worrying if they were to deliver anywhere near the proper date.

There must be a reason why one firm can deliver, and so far as one can see, it is a triumph, not so much of organisation as of drive, of concentration on the one vital point of delivery. Success in this case is achieved not by the piling of system upon system, form upon form, watch-dog upon watch-dog, but by the simplification of routine and the realisation that delivery is a serious responsibility. In many a firm the manufacturing information is often not sent into the shops until after the delivery date has passed. What notice will the works take of "Urgent," "Rush Job," and other stereotyped expressions in such a case? Moreover, it is often known that the job cannot be started for several weeks, unless it be taken out of its turn. This means putting on one side other jobs already late, and complete disorganisation of the whole system. This disorganisation is the prime cause of high prices. Further, no firm that is consistently late in delivery can ever be satisfactory to its customers or its shareholders.

Lateness in delivery is not the only trouble. It is difficult to get many firms even to quote rapidly. From eight recent quotations for comparatively simple and standard apparatus, the average time between inquiry and quotation is 12 days. These quotations were obtained from four firms, and relate to three separate jobs, varying in value from £300 to £2,000. A ninth inquiry, issued six weeks ago, for gear which is quite standard except that the primary voltage is 30,000, has as yet elicited nothing but three successive promises that a quotation shall be sent in two or three days.

At the same time, on a Spanish contract it was considered advisable to send an inquiry to a continental manufacturer. The reply was received in eight days, and, in view of the length of time necessary to settle a foreign contract, the tender was open for acceptance within 90 days, in place of the usual month.

For a final case: Competitive tenders for electrical gear worth about £1,000 had been received, and the order was about to be placed when another manufacturer asked permission to quote. The inquiry was sent to him, and the order was held up. The quotation arrived in 17 days. Surely it was not expected that the order would be held up quite so long?

Of course, one must sympathetically realise the difficulties of the manufacturers on this point as well. The sales organisation has other duties besides quoting. It has, for instance, to placate the angry customer who cannot get delivery. Moreover, there is a manufacturers' association to attend, and one must meet one's competitors. How often in the restaurants near Kingsway does one see a galaxy of sales managers who, if only they were to meet their customers, might do some really big business! Of course, for many of them the offices in King's House are more comfortable than their own, or even than their customers'. The poor customer can rarely afford comfort in his office when he has paid for his electrical equipments. And so, while all around are firms striving to install British electrical goods here and abroad, the electrical manufacturers sit and while away the time in academic discussion of the division of their own problematical profits. They organise and re-organise the industry, while the firms they represent are in chaos.

Let them beware the premature counting of chicks. They may divide their profits as they will—if they do not deliver

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promptly there may be no profits. They may decide how orders are to be apportioned among themselves. If they do not quote quickly and reasonably, there will be no orders.

If they can contemplate even that with equanimity, then let them bestir themselves for very shame. By their lack of initiative they are stifling other industries, they are hindering the progress of the century, they are making our longed-for reconstruction a hotch-potch, a mere patchwork of existing iniquities.

Imperial.

London, *March 7th*, 1919.

Engineer Surveyors' Salaries.

Like one of your correspondents, I have been with a very prominent engineering insurance company for 16 years, and my salary is £280, including a war bonus of £50. This is about the usual salary paid by the three most important—the Vulcan, National, and British—engineering insurance companies. This is very different to the scale paid to the Ocean Co.'s surveyors, as per Mr. Forsyth, and I must thank him in the name of all surveyors for stating this scale. It is up to the Executive of the Engineer Surveyors' Association to bestir itself, and demand this scale from all the companies. I was surprised at the tone of the recent letter from Mr. Thrapnell, the Secretary. Another very unfair point the E.S.A. should take up, and get abolished, is the agreement between the several companies not to employ each other's surveyors. This stops competition, and keeps the salaries down. The E.P.E.A. has worked wonders for its members; let us see the Engineer Surveyors' Association Executive doing something for its members.

Electric.

March 8th, 1919.

The Association of Officers and Staff Members of Electricity (Power and Supply) Companies of Great Britain.

The formation of an association with the above title advocated in your issue of February 28th would scarcely seem necessary now that the technical staffs, not merely of company, but also of municipal undertakings, are strongly organised in the Electrical Power Engineers' Association, and that the commercial staffs appear in a fair way shortly to secure equally strong representation in the Chief Commercial Officers' Association and the Clerical Assistants' Association.

Sectional associations, such as that proposed for a specific object, only lead to duplication of effort which, in the opinion of many, would be much better applied to strengthening existing organisations.

This and similar questions affecting the future position and prospects of technical staffs have received the attention of the National Executive Council of the E.P.E.A., and a deputation from the Council has already put the views of the Association before the Board of Trade at an interview on the 12th ultimo with the permanent officials and Sir John Snell, the electrical adviser to the Board of Trade, in connection with the new Bill.

Certain information was given in confidence to the deputation as to the protection to be included in the Bill for employés of electricity supply undertakings, and these matters will continue to receive the closest attention of the Council, which, I have no doubt, would gladly co-operate with other representative associations to secure adequate protection of the interests of the officials as a whole under the national electricity supply scheme.

C. Vernier.

Gosforth, *March 4th*, 1919.

An Association for Technical Staffs.

Referring to the letter under this heading, signed "Five of Them," I have to advise you that if the gentlemen in question or other interested persons will get into communication with me, I should be happy to give them information which may be of some service.

Norman Wyld.

25, Victoria Street, S.W. 1, *March 9th*, 1919.

Strike Prosecutions.

Recently, certain Bolshevist trade unions created a certain amount of panic in London by threatening to plunge that city in darkness.

Your paper has had a great deal to say on this matter, both in the editorial and "Correspondence" columns, apparently being under the delusion that those who made the threats had the power to carry them out; whereas such is not the case.

The people of London may rest assured that no such thing as "total extinction" will take place in that city, or county; for there is in existence a strong organisation, with a rather long name, which, while properly safeguarding the interests of its members, fully recognises the duty it owes to the community; and is ready to assist the forces of law and order to overcome any anarchist outbreak that may occur.

It is mainly due to the existence of this organisation that London has been practically free from strikes, as regards the electrical industry.

Other organisations have glibly talked of "striking," and even at the present moment are busy voting on that very question, but the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers are banded together to prevent, as far as possible, the recourse of the workers to this primitive and dangerous weapon.

Such being the case, I was confounded when my attention was drawn to a certain article in the Electrical Review of February 28th, 1919, which, among other inaccuracies, stated that the president of the Camberwell branch of the Electrical Workers' Union, being out on strike, attacked another man who was proceeding to work.

Now, sir, a lie which is half truth is the very worst of lies, and, as the secretary of the Camberwell branch of the Electrical Workers' Union, I demand from you an apology for the libellous statements contained in the article mentioned, both to Mr. Weeks and to my branch.

I may state that Mr. Weeks, our president, has been taxing his strength to the uttermost during the past six months, working in the interests both of employers and employés; and, I am glad to say, his efforts have been crowned with complete success, perfect harmony resulting between the two classes.

He has just arisen from a sick bed, having been nearly killed by his assailant, and an article like that in the Electrical Review is not conducive to helping on the recovery of one of his temperament.

Further, he is one of those who gave up all, and went out to fight in the cause of liberty and justice, and, when incapacitated for further service abroad, he was discharged; he then took up the fight in the industrial world.

I do not think there is any need to mention the Camberwell branch again, unless it is to say that it could be swelled to double its membership if it would agree to take in those who are thoroughly disgusted with the Bolshevist tactics of an organisation which has been so ably advertised in your paper.

Arthur J. Nicholls,
Secretary,
National Amalgamated Union of Enginemen, Motormen, &c., Camberwell Branch.

London, S.E. 6, *March 7th*, 1919.

[The error in question was corrected in our last issue, p. 270.—Eds. Elec. Rev.]

The Re-settlement of Officers.

The leading article in your issue of January 24th, *re* re-settlement of officers, caused me a certain amount of amusement. It appears to be a universal opinion that England's educated and highly trained gentlemen are all officers. Surely there are absolutely no grounds for this assumption. You must remember that on the outbreak of war the authorities were very particular, as they are in peace times, about granting commissions, and many men not having the necessary influence preferred to join the ranks from purely patriotic motives rather than await the pleasure of the W.O. These, too, in many cases did not join the R.E., because, as you mentioned, electricity does not figure very largely in the training of that corps.

As the war progressed, and the shortage of officers made itself felt, commissions were easily had, with the result that quite a number were given to men of "fine personal appearance, plenty of swank and bluff," and whose sole idea in taking a commission was to improve their surroundings, wear a smart uniform, and be able to go where a mere ranker could not—in short—for social reasons. Now, is it right to help this class of man more than, say, a man of equal or even better education who has the "guts" to stick the rough and tumble of the ranks?

The educational standard necessary to qualify for a New Army commission is equivalent to that required by a youth aspiring to the exalted position of office boy to a business firm. If your writer has had any extensive experience of the present-day Army officer and his duties, or rather his interpretation of them, and the execution thereof, he must be fully cognisant of the mentally dulling effect of the stereotyped labour.

I do not wish to belittle our officers in any way, but, in Army parlance, three-quarters of them are absolute "wash-outs." Take the engineering branch of the Army; it is justly called a d——d good firm to work for, because you have unlimited funds for your work and no "sack." Would a civilian employer encourage an engineer who starts a job and does his thinking afterwards? There is no doubt that many an officer has had praise for work he could never hope to carry through but for the able men under him. In fact, some of the suggestions made would make an angel weep.

I am writing from personal experience of the Army in Egypt; we may have had better brains in France, but certainly none trickled to this front.

The Army has a system of training a man, regardless of any previous qualifications, to fill vacancies which occur. This may be all right, because he usually has a qualified man on whom he can lean in days of trouble. What will be the

result when he gets back to civilian life? Many a poor employer will get burnt, I am afraid. Again, from your advertisements, all officers seem to want managers' jobs. Do they imagine that the Army system will still hold good, of being able to give orders and not show how a job is to be done? I have seen a fair amount of work in the engineering line carried out in the Army, and not once have I seen even a diagram of connections or a working sketch. If a fully qualified electrical man enlisted in the R.E.'s he would be laughed at for saying he was an electrical engineer; only officers can be so called, he is simply an electrician, though he may have been a station engineer with good technical training and plenty of experience.

I must apologise for having written at such length, but these matters cannot be discussed in a few words. It is well known that liquids find their own level, so, I say, allow these temporary gentlemen to find theirs, without any preference because they happen to have been officers.

Fed Up.

Alexandria, *February 18th*, 1919.

[While we sympathise with our correspondent, we think he might have been good enough to read our article carefully before he so fiercely assailed it. There are both officers and men in the Army; why should we write only about the men—as we have done so often—and be forbidden to champion the cause of the officers also? Everyone knows that many—very many—educated and highly trained men enlisted in the ranks—all honour to them. We are familiar, too, with the type of officer who should never have received a commission, and with the mental paralysis to which Army routine is apt to give rise. But there are other regiments besides the Royal Engineers, and it is well known that, especially in the earlier years of the war, the subaltern was called upon to face fearful risks in leading his platoon to the attack, and the mortality in the class of young officers was very heavy. Their self-sacrifice will ever be held in remembrance, and those who survived the fiery ordeal have a just claim to special consideration.

Returning to the article, this was written specially with regard to the issue of a pamphlet on the subject named in the title, and naturally it did not deal with matters outside the scope of the text. It will be remembered that the future prospects of no fewer than 400,000 men "*of the officer type*" (including therefore a large proportion of the N.C.O.'s and men) were in question. We referred in it to the many "wealthy men and men of position" in the ranks; we endorsed the remark in the pamphlet to the effect that the average young officer would have to make up his mind to fight for his bread and butter on the merits of his training, education and character; we fear that many who come back will, as our correspondent suggests, have to undergo a painful disillusionment—but we see no reason why all our solicitude should be allotted to the men to the exclusion of "the officer type," and we are quite sure that the men who followed their leaders over the top with sublime trust and reckless daring would be the last to wish us to adopt that course.—Eds. Elec. Rev.]

Educational Reform.

As a small supplement to Colonel O'Meara's recent extremely important paper, perhaps I can usefully call attention to the fact that amongst other counteracting advantages the war has certainly aroused parents to the desirability of a changed educational curriculum at our public schools, as well as at Oxford and Cambridge.

Soon after hostilities set in there occurred, it will be remembered, a general discussion in the Press on the subject, with the result that a committee was formed which had for its special object a reformed public school education. I became a member of this committee, of which Lord Desborough was chairman.

The first step taken was to apply to all the parents of the leading public schools (27 in all) inquiring whether they would favour a fuller education in science and modern languages, even though involving a smaller amount of time being spent on Greek and Latin. As the largest and perhaps the most conservative school, Eton may be usefully quoted as an example. Out of some 900 parents circularised, 536 replies were received, of which 512 favoured such a change; 12 were against, and 12 neutral. In other instances the result was still more striking.

The next step taken was to form a deputation to attend at the Headmasters' Association of that year. The deputation was exceedingly well received, and seems already to have had some effect at several of the public schools.

Whilst a firm believer in the public school as the best means of forming character—for which the Allied Forces have much to be thankful—I cannot help thinking that most of what Colonel O'Meara so ably pleads for will be more readily brought about with the changed school curriculum that I refer to.

I would like further to warmly endorse some of Mr. Highfield's remarks in the discussion relative to the great improvement effected in many of the younger generation by their experience at the Front. Many have undoubtedly become for the first time competent to manage men effectively, and this is really one of the most important characteristics of a successful engineer. Having sometimes to select candidates for important positions in Australia, I am usually struck with the small proportion who are imbued with any such capacities as compared with those eminently efficient technically.

Charles Bright.

London, S.W., *March 11th*, 1919.

Early Wireless Telegraphy.

As an old telegraph engineer, and for years employed on the R.E. engineering staff, P.O. telegraphs, where I received my early training, I am naturally interested in the letters in the Electrical Review relating to the pioneers of this wonderful discovery. It has been for years the impression with many of us interested in this branch that Mr. Marconi, when he first arrived in this country, was given every assistance by the British Post Office, even suitable positions at coast-guard stations were placed at his disposal, and I think rightly so, as there is no doubt the energy Mr. Marconi put into the work advanced wireless several years. But in fairness to the late Sir William Preece, I might mention that under Mr. Preece's instructions a party of us engineers with the then Lieut. Bagnold, R.E., in charge, experimented in 1884 in signalling across the Solent without wires, and signals were transmitted and received, but on account of the unsuitable apparatus then in use they were almost inaudible. This would be years before Mr. Marconi came to this country. A short paragraph on our experiment can be found in the first number of the *Military Telegraph Bulletin* of 1884, a paper which was printed and published by the R.E.'s, and circulated in the service, and I understand a copy of it is in the library of the Institution of Electrical Engineers.

H. G. Andrews.

Bournemouth, *March 10th*, 1919.

How NOT to Obtain a Situation.

Undoubtedly applying for a position is an art possessed by few. Some have it in speech, and some in literature. Carelessness in either gets its due reward. No doubt, as "Static" writes, there are fools amongst the applicants, but there are also fools, designing fools, amongst the advertisers. Look down the "vacants" and note the fund of information given for the guidance of applicants. Nothing to show type, size of plant, location of the works, or anything else of an informative nature, and yet it is expected that the salary that could be accepted will be stated.

Recently, I believe, Wolverhampton advertised for a shift engineer: "State salary, &c." What was the object? There are shift engineers there doing the same work that is required to be done by the new man, and paid a salary. Why not state it?

Again, the slackness in acknowledging an application or notifying the result is all conducive to indifference on the part of the applicant.

Two Sides.

March 9th, 1919.

Electrified Seed.

As long as it was possible to pretend that "Wide Awake" was in earnest, I was willing to answer his questions, but I am not willing to take part in a farce.

Charles Mercier.

Parkstone, *March 10th*, 1919.

Correction.—We regret that the name of the writer of the letter on "Telephone Facilities at the Patent Office" in our last issue was printed as "A. H. Moore"; it should have been "A. H. Morse."

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

Further contributions as under have been received in response to the appeal made by Mr. Hunter, the chairman of the Institution:—

	£	s.	d.		£	s.	d.
Jane Ellis	1	0	0	E. L. Joseph	1	1	0
E. H. Harrison	0	10	6	E. Williamson	0	10	6
Small Electric Motors, Ltd.	2	2	0	W. Ratcliffe Small	10	10	0
H. G. Richardson & Co. ..	1	1	0	Justus Eck	3	0	0
A. C. Robinson	0	10	0	British Elec. Equip. Co. ..	1	1	0

Westinghouse War Relief Fund.—We have received a copy of the financial statement of the British Westinghouse Employés' War Relief Fund from August, 1914, to December 31st, 1918. The total contributions for the period were £63,150, of which £41,359 was contributed by the employés, and £21,791 by the company. There was paid out to dependents £45,097; set aside for a Disablement and Dependents' Fund, £12,764; while £2,890 has been spent in donations to local and national funds and Christmas gifts. The number of families in receipt of weekly relief is now 820; 3,516 of the company's employés joined the Forces: 269 have lost their lives, and there are 117 widows on the list. The statement was adopted at a meeting of delegates, held in the Women's Canteen at Trafford Park on February 10th.

BUSINESS NOTES.

Our Letters from the Forces.—In thanking us for sending the Electrical Review to him during three years' absence from home with the Forces, a demobilised correspondent writes:—"I feel, in common with other members of the detachment with which I have been employed, that it is due to the Review that we are able to return to 'civvy' life without feeling absolutely lost, as by its aid we have been able to keep *au fait* with developments in the electrical world. Having cooked Fritz's goose in the way of fighting, we are now going to have a good old go at him on the commercial side, and we are indebted to the Review for keeping us in trim for this fight, which looks like being as big a job as the other."

Lead.—Messrs. James Forster & Co., in their report dated March 8th, state:—

No transactions have taken place on the open market, but considerable business has been done privately this week at round about £26 10s. for prompt delivery.

For March shipment £28 is asked, and for forward the price is better by £2 to £3 on the week, there being buyers at £26 for May and £25 10s. for June.

Interest in the metal has been decidedly quickened by the lower prices, and has certainly not been lessened by the shutting down of the Fremantle Mines (Australia) and the threatened like action in Spain, owing in both cases to the cost of production exceeding price obtainable; in the latter case, combined with political unrest. The shutting down of the Spanish mines for any considerable time would quickly neutralise the existence of large stocks.

The large stock held by the Government (now 100,000 tons) will continue to weigh with buyers; but, on the other hand, the consumption of lead will be far and away above anything we have seen in the past as soon as the Government Building Scheme is under way, and apart from that an enormous increased consumption for electrical purposes and of white lead—the necessity of which is felt in every building and home in the country—is bound to come. On the whole, we can see little reason for lower prices unless the Government throw their lead on the market.

Foreign Trade.—The February Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

Imports.	*February*, 1919.	*Inc. or dec.*	2 *months*, 1919. *Inc. or dec.*
	£	£	£
Electrical goods, &c. ...	136,859	+ 80,983	+ 26,265
Machinery	1,269,275	+ 162,938	+ 770,886
Exports.			
Electrical goods, &c. ...	246,391	+ 89,846	+ 244,285
Machinery	1,554,108	+ 228,777	+ 700,795

Prices Advancing in Germany.—It is reported from Berlin that the prices for raw materials and semi-finished articles used by the electrical trades experienced a further increase in February, and still further advances have been notified as being in prospect. The higher wages also have brought about an augmentation in the costs of production of the electrical firms. Nevertheless, the Central Union of the Electrotechnical Industry, at a meeting held on February 20th, decided to abstain from raising prices on that occasion, but to leave the matter until the further meeting of the Union later in the present month. It is then expected that the quotations for manufactures will be increased by a very considerable extent.

Trade with Belgium. — Apart from the enormous quantity of raw materials which will be required in connection with the economic reconstruction of Belgium, a large demand will also arise for a long time for manufactures of various kinds until the country is able to reassume the pre-war position as a result of the rehabilitation of the works and factories destroyed or rendered useless by the enemy. These circumstances have already been appreciated in certain trades in Great Britain, but the electrical industry appears to have made no indication of desiring to participate in the business. The British Vice-Consulate at Brussels, for instance, has informed the Belgian public that numerous British manufacturers wish to get into communication with persons in Belgium who would undertake eventually to represent them in different parts of that country, and those interested have been invited to forward applications to the Vice-Consulate, together with references. The list of trades published by the Consulate, however, does not include any electrical manufacturers. Is it to be assumed, therefore, that British electrical firms have no interests to promote in Belgium?

Metal Prices.—The Minister of Munitions announced last week the following increase in the maximum price of tinplate for home sales as from March 1st, 1919:—

Coke Tinplate.—I.C. 20 × 14 112 sheets 108 lbs. 33s. 10d. basis, per box, net, f.o.t. at makers' works.

The maximum price for home sales of bar iron, marked bars, rolled edges, iron strip, sheared iron tube trip, and iron plates and sheets, was advanced 30s. per ton, on March 6th.

A Rugby Dinner.—The supply department of the British Thomson-Houston Co., Ltd., held their annual dinner in the Royal George Hotel, Rugby, on February 27th. Mr. J. A. Phillips was in the chair, and following on the dinner a smoking concert took place. Mr. W. J. Cusack, in proposing the toast of the department, made reference to the amount of war work handled by the supply department, it being stated that this amounted to nearly twice the pre-war output. A welcome was extended to those members just returned from the Forces, two of whom had gained the Military Cross, and a vote of thanks was accorded to the members of branch offices who had returned to head office and given a helping hand during strenuous years.

The French Electrical Industry.—The representative trade associations, or chambres syndicales, in France are now being given through their respective presidents, an effective and permanent representation in relation to the Government authorities, and they will thus be able to set forth their wishes officially to the Government and with the official recognition of their status by the latter. For this purpose the Minister of Commerce has decided to group the industries or trades in 20 classes, two of which have just been constituted. The first group deals with public works and buildings, and comprises over 200 chambres syndicales. The second comprises electricity, public lighting and tramways, and it includes all the chambres concerned with these branches. As the provisional bureau for this group there have been elected, as president, M. G. Cordier, president of the Union des Syndicats de l'Electricité, as vice-president, M. M. Meyer, president of the Syndicat Professionel des Industries Electrique, and, as members, MM. Jnug, de Seynes Berthelot and Masse. A combination of this nature should be of value to the industry in its relations with the Government on matters affecting the trade. Besides being grouped officially, the electrical industry is one of the constituents of the Union of Metallurgical and Mining Industries, Mechanical Construction, Electricity, and Accessory Industries, and as such has participated in the protest which has been raised by the Union against the insinuations recently made in Parliament alleging profiteering, together with other charges, on the part of the iron and steel, mechanical and electrical engineering and motor-car industries during the course of the war. The Union has repudiated the charges, and states that the industries in question have worked in perfect agreement in the general interest of the country. The Legislative Chambers have now sanctioned an inquiry into the question, with particular reference to the iron and steel industry.

Stocks of Non-Ferrous Materials.—The following particulars are published of the stocks (exclusive of old metal and scrap) in this country in possession of the Minister of Munitions on March 1st, 1919:—

Copper	51,873 tons	Soft pig lead	100,068 tons
Spelter G.O.B.	27,444 ,,	Nickel	2,332 ,,
,, refined	8,860 ,,	Antimony regulus ..	4,825 ,,
Aluminium	13,004 ,,		

New French Company.—La Société des Constructions Electriques du Rhone (Procédès Dick, Kerr) is the name of a new company which has lately been formed in Paris, with a capital of £320,000.

"Paragon" Thermo-Electric Ship Propulsion (Patents).—Mr. William P. Durtnall, inventor and patentee of the above system of ship propulsion, and speed-reducing from high-speed prime movers such as steam turbines or internal-combustion engines to ships' propellers, has asked us to mention that certain patent specifications have been since 1912 sold by the Patent Office Sales Department (inadvertently), not bearing the official stamp; recently whilst travelling in France he came across such an unstamped document. Mr. Durtnall, on his return, immediately took steps to draw the attention of the Comptroller-General to this error, and that official has acknowledged the matter by the issue of an officially-stamped and signed document, a lithographic copy of which we have examined; the patent referred to was No. 19,903/1911, applied for by a Swedish firm.

New Works.—It is stated that the skating rink at Stacksteads, Bacup, has been purchased by Mr. S. O. Ashworth, of Waterfoot, for the Ironclad Switchgear Co., Ltd., electrical engineers, of Manchester, of which he is a director. It is expected that work will be commenced in about two months' time, provided the necessary machinery and shafting is procurable.

Trade Commissioner at Sydney.—The B. of T. has approved the appointment of Major G. Fetherston, D.S.O., M.C., as Trade Commissioner at Sydney. The new Commissioner has had much commercial experience in the hardware, shipping, and general agency business in New Zealand. He will remain at the London headquarters of the Department of Overseas Trade for a short period before taking up duty in Australia.

Export Restrictions Relaxed.—The *London Gazette*, of March 7th, contains a notice of further relaxations of export restrictions.

Trading With the Enemy.—A further list of names of bodies and persons in foreign countries with whom trading is prohibited, or whose names have now been removed, is published in the *London Gazette* for March 7th.

Excess Profits Orders.—The Board of Referees has considered an application by Messrs. Stanley, Wasbrough, Doggett and Baker, of 1, Albemarle Street, W., on behalf of makers of permanent magnets for an increase of the statutory percentage respecting the business of making permanent magnets in the United Kingdom. The Board has made an Order increasing the percentage in the case of any trade or business carried on or owned by a company or other body corporate, to 11 per cent. with additional percentages in the case of other trade or business, as specified in the Order.

A similar Order made in respect of the Chile Telephone Co., Ltd. ("the business of supplying telephone service throughout the Republic of Chile, South America"), increases the percentage to 7½ per cent., with additions in specified cases.

Exports to China.—In the *London Gazette* for March 7th there appears a further list of firms, &c., in China to whom exports may be consigned.

Bankruptcy Proceedings.—Henry William Hill, instrument maker and electrician, 58, Rossiter Road, Balham (late 64A, Battersea Rise, London).—According to the statement of affairs lodged by the debtor in this case the gross liabilities amount to £287, of which £284 are expected to rank for dividend. The assets are set down at £10, or a deficiency of £274. The failure is attributed by the debtor to "decline of business by reason of being unable to obtain materials and labour owing to the war." It appears that in 1910 the debtor commenced business in partnership with others in South London, and shortly afterwards the business was turned into a limited liability company. Debentures were issued, but about March, 1913, a Receiver was appointed, and the debtor remained as manager for the purchaser of the concern. In August, 1913, debtor started in partnership with another man, and the business of electrical engineers was carried on. The partnership was dissolved in August, 1914. In the same year the debtor commenced business on his own account as an instrument maker and electrician, with a capital of about £10, and that business he carried on up to the date of the Receiving Order. Early in 1917 debtor found he was unable to obtain materials and labour, with the result that business declined and creditors began to press for payment of their debts. In order to pay pressing liabilities he borrowed money from friends, and gradually disposed of the assets. At the date of the Receiving Order a number of creditors had obtained judgment, and he filed his own petition. At the first meeting of creditors, held on March 3rd at 132, York Road, Westminster Bridge Road, S.E., the matter was left in the hands of the Official Receiver to administer in the usual way.

Charles Mayfield, electrical engineer, 19, All Saints' Road Clifton, Bristol.—This public examination took place at the Guildhall, Bristol, on March 7th. Debtor admitted a deficiency of £1,342. He had carried on business at Clifton since September, 1916, having previously been engaged in munition work in London. He understood invention and research work, and his earnings averaged about £2 a week. Money was advanced for the purpose of developing patents, and provisional specifications were lodged, but, owing to various difficulties, the patents were not proceeded with. He had an agency for music, art, and science, and wrote some film plays as well as revues. He brought out some inventions, including a luminous candle, but they were of no value to anybody. The result of his having been in business for upwards of two years was the deficiency of £1,342, a loss of practically £600 per annum. He attributed his position to heavy expenses in experimenting and developing his inventions, inability to develop his electrical business on account of the war, and law costs and interest on loans from money-lenders. The examination was ordered to be adjourned.

Calcium Carbide Order Suspended.—The Calcium Carbide Order, 1917, has been suspended by the Ministry of Munitions as from March 7th.

Catalogues wanted for South Africa.—Messrs. Maytham Tin and Steelware, Ltd., of East London, write as follows under date February 10th, 1919:—"We shall be glad if through the agency of the Electrical Review you can have a supply of catalogues and price lists sent us. We are interested in all lighting accessories, heating and cooking utensils (electrical), and small motors. We particularly want to get in touch with makers of ironclad high-voltage switches, with the cartridge or "Zed" type fuses. Since the Armistice we have not received a single catalogue, and, owing to the smallness of stocks in hand, we are anxious to refit. Prices should be quoted us for cash against documents in London. Only genuine British firms are wanted. No neutral or naturalised alien of any nationality need worry us."

Dinner.—A Victory dinner and concert was recently held at Luton by Messrs. L. Weekes, Ltd. (incorporating the British Electric Calibrated Fuse Co. and the Safetee Controlling Appliances Co., Ltd.). A large company of employés and friends sat down to dinner, Mr. Lawrence Weekes presiding. Among the toasts was "The Employés," proposed by the chairman. After referring to the important activities of the concern during the war, he said he was confident that they would grow and succeed in Peace trade better than they had done in War trade. He hoped that the employés would continue to earn big wages and bonuses, but they must keep the output at the maximum. They were now reduced to a 47-hour week, and he had another idea of giving them a complete Saturday holiday. He was out to make money as well as the employés. Establishment charges mounted up more than they realised, and the total was spread over the amount of output. They must double the output, go on employing more labour, and so increase the benefits all round. The toast was responded to by Mr. W. Simmons, the oldest employé, and Mr. A. Thurley. "The Firm." was proposed by Mr. A. Smith, and responded to by Mr. Coom (a director), who, in the course of his remarks, said that negotiations were in progress for new works, where they hoped to have their own sports ground, pavilion, &c. The new Peace Trade included foreign trade, and they must be able to quote competitive prices; the lower the price the greater would be the work. He announced that the following Saturday morning would be a holiday. Other toasts were "The Staff" and "The Visitors."

Manufacture of Tramcars in Australia.—The Melbourne, Brunswick, and Coburg Electric Tramway Trust is installing a complete plant for the manufacture of electric tramcars and accessories. The Trust is proceeding with the construction of six cars for its own use, and has an order for eight cars for a neighbouring municipality. It is estimated that a saving of £200 per car will be effected over imported cars.

The Coal Crisis and Industry.—Last week-end the following notice was posted in the works of Vickers, Ltd., at Sheffield:—

"The company has not been able to accumulate more than a few days' stock of coal, and if the threatened strike of miners takes place it will be impossible to carry on in the departments which are large coal-users. Other departments will be kept going as long as possible, but the company regret to have to give notice hereby to determine the services of all workpeople on March 22nd, 1919; and unless the supply of coal is assured, engagements from that date will only be from day to day."

The *Daily Telegraph* says that the intention of this notice is regarded as purely precautionary. The company wish to prepare the men for all eventualities, but it is not anticipated that any such measures will be found necessary.

The Overseas Trade Department and Exporters.—In order further to assist exporters to recover their trade in goods of which the export is, or has been, controlled, and generally to ensure that no openings for trade are lost to British exporters owing to ignorance of existing export facilities, the Department of Overseas Trade, in concert with the War Trade Department, has made arrangements for bringing to the notice of exporters, through the medium of the Press, trade journals, Chambers of Commerce, and trade organisations, and by special notes direct to firms on the "Special Register" of the Department, information regarding changes affecting control over exports. Firms not already on the Special Register who desire to receive such information direct from the Department may apply for admission to the Special Register to the Comptroller-General, Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, E.C. 2. The annual fee for admission to the Special Register is £2 2s., which includes the supply of the *Board of Trade Journal*.

It is understood that, owing to the necessary formalities and consequent delay in connection with the obtaining of export licences, exporters find themselves at a disadvantage when dealing with orders requiring immediate acceptance. The Department will, therefore, on request, undertake to ascertain from the War Trade Department, and reply by telegram or telephone, at the earliest possible moment, whether licences will or will not be granted for such orders. In the event of an applicant being promised a licence, he will be enabled to deal with the order straightaway with the knowledge that upon application being made formally to the War Trade Department the licence will be granted. Inquiries should be made by telegram rather than by telephone, and should be addressed to "Orders c/o Advantage, Stock, London." They should give, in addition to the name and postal or telegraphic address of the applicant, the quantity, value and description of the goods comprised in the order, and the name and address of the ultimate consignee if the goods are destined for a neutral country. In the case of orders from Allied or British territory, or from territory in the occupation of troops of the associated Governments, the consignee need not be stated; the country of destination will, of course, need to be given. A reply of 24 words (1s. 6d.) must also be prepaid. Applicants are requested in their own interest to confine their inquiries to orders needing a very urgent decision, since the fewer the inquiries the more promptly can answers be given.

British Industrial Delegation in Paris.—According to *The Times*, there arrived in Paris on Wednesday, last week, a delegation from the Federation of British Industries, who have gone to France to confer, under the auspices of M. Clementel and the British Ambassador, with important industrial interests of France. The object of the visit is to discuss the methods by which British industry can co-operate in the industrial reconstruction of France and in dealing with post-war trade problems. Included among the delegates, whose headquarters are the Hôtel Continental, Paris, are Mr. G. H. Locock, assistant director, F.B.I.; Mr. S. P. Leigh, secretary, F.B.I. delegation; Mr. G. F. Hall, travelling representative; Mr. D. A. Bremner, British Engineers' Association; Mr. D. N. Dunlop, B.E.A.M.A.; Mr. C. H. Dade and Lord Vaux of Harrowden, representing the B.E.T. Co. and the British Electrical Federation respectively; and many others.

Australia and British Goods.—Cables from Melbourne state that a proclamation has been issued by the Minister of Customs prohibiting the importation into the Commonwealth of all goods other than those of British origin.

Strike.—The strike of transformer workers and semi-skilled men at the works of Messrs. Ferranti, Ltd., electrical engineers, Hollinwood, and the British Westinghouse Co., Ltd., Trafford Park, Manchester, has been settled, the men who struck in sympathy returning to work on Thursday, last week, pending negotiations. Later in the day a joint meeting of the local branch of the Electrical Trades Union and the Engineering Trades Employers' Association was held, at which an agreement was arrived at, whereby the minimum rate for transformer workers will be 35s. per week on the pre-war rate. It was also agreed that there should be a grading scheme whereby the minimum should be reached in 18 months. The men have been on strike about a month, and recently it was decided to take a ballot on the question of a general strike of electrical workers in the city and district. As a result of the agreement, of course, the ballot becomes inoperative.

Reconstruction Problems.—No. 15 of the series of pamphlets issued by the Ministry of Reconstruction deals with the important subject of "Juvenile Employment."

Australian Copper.—Australian newspapers just to hand show that there was a heavy collapse of copper shares on the Sydney Stock Exchange early in January when it was known that the contract of the British Government with the Australian metal producers for the supply of copper had terminated. It was estimated at that date that the depreciation in the value of scrip within a few months had been nearly one million, the chief being in Mount Morgan, which had gone back by £250,000. According to the Sydney *Sun* for January 12th, Mr. A. A. Boyd, general manager of the Mount Morgan G.M. Co., had received advice from the company's Melbourne office to the effect that all attempts to make a sale of copper had been unsuccessful, and that there was no immediate prospect that the company's output of copper could be disposed of.

Mr. Boyd said it appeared as if the company would be unable to secure freight for any of its copper for the next six months. It also appeared that the vessels then going to Australia were under British control, and would lift preferentially different materials already purchased by the British Government. "This means," said Mr. Boyd, "that practically none of our 1919 copper will be saleable until fully nine months after production, and then almost certainly at a lower price. For the present it is the intention of the directors that mining and treatment shall proceed as usual. How long this might continue depended largely upon the exercise of rigid economy, together with an increased efficiency in productive operations, and on the future of the copper market. It was only by co-operation on the part of the employé and employer that the copper industry could be successfully conducted through the trying period ahead."

Large Sydney sharebrokers endorsed the opinion of Mr. Boyd. Many were inclined to think that the market might go still lower, unless the Federal Government was able to arrange for the sale of production with the British Government for delivery throughout this year. Mr. J. L. Wharton, chairman of directors of the Hampden-Cloncurry Co., stated that his company was in a similar position to the Mount Morgan Co. Very large quantities of copper were awaiting shipment at the Electrolytic Refining and Smelting Co.'s works at Port Kembla. As soon as vessels arrived from Great Britain to load Australian wool, there would be an opportunity of clearing off this surplus.

The Mount Cuthbert officially stated that it did not intend to resume copper production at present. It was the intention of the Board fully to overhaul the machinery and effect extensive repairs while the smelter was idle. Practically the whole of its 1918 output of copper, which had been electrolytically refined, was lying at Port Kembla, but the greater portion of that tonnage had been paid for by the British Munitions Department, and only the November output was unsold.

Catalogues.—Messrs. Higgs Bros., Summer Hill Street, Birmingham.—36-page illustrated catalogue of their C.C. and A.C., electric motors, and C.C. dynamos. Specification information, effectively coloured sectional views of complete machines, half-tone views of machines and parts thereof, dimensioned drawings, tabulated powers, speeds, prices, code-words, &c., are all given. The matter is set out in a businesslike way. The list contains particulars of new ranges of machines recently put on the market. The firm concentrate their attention upon the design and manufacture of electric motors, and they rightly claim to be specialists on small and medium-sized machines.

Liquidations and Dissolutions.—Robertson Electric Lamps, Ltd.—Winding up voluntarily. Liquidator, Mr. J. Fraser, 31, Copthall Avenue, London, E.C. Meeting of creditors, March 18th.

Perry & Co., electric light fitting manufacturers and electricians, 21, Grafton Street, London, W.—Messrs. R. Wason, J. St. John Smith, and B. G. St. John Smith have dissolved partnership. Debts will be attended to by Mr. R. Wason, who will continue the business under the same title at the same address.

Under the Trading with the Enemy Amendment Act, the Board of Trade has ordered the realisation and distribution of the assets of the undermentioned business :—

Calor Co., Ltd., 183-6, High Holborn, London, W.C.—Holders of patent rights for the manufacture of fuel briquettes. Controller, H. A. Booty, 14, George Street, Mansion House, E.C. 4.

R. Wolf, Ltd., 7, Laurence Pountney Hill, London, E.C. 4., engineers and merchants.—The Board of Trade has ordered, under the Trading with the Enemy Amendment Act, 1918, the realisation and distribution of the assets in this case. Controller, A. Dangerfield, 56, Cannon Street, E.C. 4.

Government Electrical Equipment to be Sold.—It is announced that the Disposal Board of the Ministry of Munitions has completed its organisation for the disposal of the quantities of electrical apparatus and equipment that were manufactured to help win the war and are now becoming available for the requirements of peace-time development. The electrical material as it comes to hand for purposes of sale will be grouped under the following headings :—

(*a*) Lighting accessories and fans; (*b*) cables; (*c*) bell materials; (*d*) electrical instruments; (*e*) telegraph materials; (*f*) telephones, C.B. and magneto; (*g*) telephones, field and intercommunication; (*h*) wireless apparatus; (*j*) searchlights, arc lamps and equipment; (*k*) plant.

Intending purchasers should write to the Disposal Board (Electrical Section, Caxton House, Westminster, S.W. 1), stating in which of the above headings they are interested. Advice of impending sales will be widely advertised through the Press, and notifications will also be sent direct to prospective purchasers as material becomes available.

Trade Announcements.—Mr. A. Williams has resigned his appointment as resident engineer and manager to the Urban Electric Supply Co., Ltd., Berwick-on-Tweed, and has commenced business as a general electrical engineer and wiring contractor, at 30, High Street, Berwick-on-Tweed. He will specialise in country house and farm installations and general maintenance. He desires to receive lists and catalogues of complete lighting sets, materials and specialities.

The Agricultural Electric Discharge Co., Ltd., have removed their registered offices from Gloucester to Birmingham. All communications should be addressed to 51, Great Charles Street, Birmingham.

Mr. W. H. Browning, for the past seven years employed by Messrs. White, Jacoby & Co., has left that firm and opened an electrical repair shop at 7, Imperial Mews, Barking Road, East Ham, E. 6.

As from March 24th all communications for the General Accessories Co., Ltd., should be addressed to 125, High Holborn, London, W.C. 1.

Mrs. Harry Bibby, widow of the late Mr. H. Bibby, electrical engineer, Bold Street, Warrington, is continuing the business.

Book Notices.—*The Decimal Educator.*—Vol. I, No. 3. London : The Association. Pp. 32. Price 6d.—The popularity of this journal, and the increasing feeling in favour of the Association's objects, are shown to a marked degree not only by letters from supporters in various parts of the country, but also by the fact that the rapid increase in the printing number, and consequent reduction in the cost of production per copy, has warranted the reduction in price by one-half. The number before us contains a portrait of James Watt, F.R.S., and among the articles such interesting subjects as "Decimal Coinage in Foreign Trade," "Swiss Metric History," "Teaching Metrics to the Young," "The Metric System in the United States," and "Decimals in Catalogues" are dealt with. There are also a number of interesting notes, as well as some manufacturers' views on the desirability of the substitution of the metric system in place of that in use in this country at the present time.

The first copy of *Ways and Means*, the new weekly review of industry, trade, commerce and social progress, published by Mr. Ernest Benn, made its appearance on March 8th (6d.). The opening notes on matters of the moment are followed by editorial articles on the mining industry, industrial organisation, Dope, and the Recollections of a Glutton. The last of these makes our hearts lighter and our pockets heavier as we indulge in retrospection, dreaming of the good old days of beef-steak puddings at the popular price of 4d. We rise to greater dignity and more seriousness when we study the signed articles by other men of eminence—"Industrial Councils : A Reasoned Policy," by the Right Hon. J. H. Whitley, M.P.; "The Responsibility of Trade Unions in Relation to Industry," by the Right Hon. J. R. Clynes, M.P.; "The Financial Situation," by Sir George Paish; and "How we Supplied our Allies with Coal," by Sir Daniel M. Stevenson. Gluttony or no gluttony, we have before us "a feast of fat things" which should satisfy the most voracious appetite for good matter on industrial subjects of the first importance. We wish the journal, which seems to us to cut quite new ground, every success.

The Aircraft Identification Book. By R. Borlase Matthews and G. T. Clarkson. London : Crosby Lockwood & Son. Price 3s. 6d. net.—The popular interest in aviation justifies the appearance of this book, which is designed to assist the observer to identify any of the types and makes of aircraft that he may meet with, except the latest British apparatus, examples of which have not been captured by the enemy. For this purpose analytical tables and diagrams are provided on a uniform system. The subject is admittedly difficult, as the art has progressed so far that many types emanating from different makers differ very little in external aspect; however, the authors have indicated the minor details of construction by which even these can be distinguished from one another. A mass of information of a general character is also given, and it is safe to say that the student of aviation, whether professional or amateur, will find the book an invaluable companion.

The *Engineering Index*, which for so many years formed an important feature of the *Engineering Magazine*, has been taken over by the American Society of Mechanical Engineers, which will extend it and make it "the most complete in the world." The transfer was primarily due to the change of name of the magazine to *Industrial Management*, together with the corresponding change of policy on the part of that journal.

"Arithmetic for Engineers." By C. B. Clapham. Pp. xi + 465; 167 figs. London : Chapman & Hall, Ltd. Price 7s. 6d. net.

Italian Companies.—The Società Varesina per Imprese Elettriche has decided to augment its capital from 7,225,000 lire to 12,325,000 lire, and to issue bonds to 3,000,000 lire.

The following companies have increased their capitals :—Le Forze Idrauliche de Trezzo, from 6,000,000 to 10,000,000 lire; Elettrica Milani, 3,000,000 to 10,000,000 lire; Elettrica Italia Centrale, 10,000,000 to 12,000,000 lire; Elettrica del Pellino, 700,000 to 1,000,000 lire; Elettrica Trevigiano, 1,200,000 to 2,000,000 lire.

The Accomendita Società Esercizi ed Applicazioni Telefoniche has converted itself into a Società Anonima, with a capital of 1,000,000, raisable to 2,000,000 lire.

Non-Ferrous Metal Industry Act.—A further list of licences granted under this Act is published in the *London Gazette* for March 11th.

LIGHTING AND POWER NOTES.

Accrington.—Alderman Sprake, at a T.C. meeting, criticised the proposal to spend £60,000 on extensions at the electricity works, and to call in an expert to advise on the scheme suggested. He said an expert could talk them into believing almost anything. In view of the proposal in favour of large power-stations, he did not think it was wise to involve themselves in an expenditure of £60,000. Alderman Higham, replying, said the department had applications for connections to works which would take about 1,000 H.P. more than they had available at present. The works compared most favourably with any other works in the kingdom. If they got value, and were meeting a necessary demand, it made no difference whether the amount was £60,000 or £600,000. The estimated saving to be effected by the new plant was expected to amount to the whole of the interest and sinking fund on the proposed outlay.

Australia.—Brisbane.—The municipality has accepted the tender of the City Electric Light Co. for the lighting of South Brisbane with electricity; at present the district is lighted with gas.

New South Wales.—A report by the chief electrical engineer on the proposed hydro-electric scheme in the Grafton district, states that 100,000 H.P. could be developed in the neighbourhood of the Clarence River Gorge. An initial scheme, to provide 6,000 KW., at a cost of £240,000, is recommended.

Tasmania.—The Ulverstone Council has been authorised to borrow £1,000 for the extension of its E.L. undertaking.—*Tenders.*

Bacup.—Extensions.—The Electricity Committee has been empowered to arrange for the supply of electricity to Britannia Quarries, Tanneries, &c., including agreements with the consumers and the Whitworth U.D.C. It has also in hand a scheme for extension of supply to Victoria Mill.

Battle.—E.L. Scheme.—Mr. Tasker has submitted to the U.D.C. an amended estimate for an E.L. installation for the town, the outlay being reduced from £25,000 to £17,600, and the revenue advanced from £1,500 to £3,279; the matter is to be reconsidered.

Blackburn.—Proposed New Station.—A deputation has been appointed to interview the B. of T. in support of the Corporation's scheme for erecting a new generating station on the Whitebirk site. The scheme has been in abeyance owing to the war, but its urgency is such that pressure is to be brought on the Board for liberty to proceed.

Brandon (Co. Durham).—E.L. Scheme.—The U.D.C. proposes to apply for powers to construct an electricity works at an estimated cost of £5,500.

Canterbury.—Price Increase.—The T.C. has fixed the charges for electricity, from March 31st, as follows:—Lighting, flat rate, 6½d. per unit, maximum demand rate, 7d. and 3½d.; outside arc lamps, 6d.; motor-generators, 3d.; gas compressors for lighting, 6d.; power and heat, 3d.; to power consumers there is to be a rebate of ½d. per unit if over 500 units per quarter are consumed, and 1d. if over 5,000.

Colchester.—Mains Extensions.—The T.C. has decided, subject to the consent of the B. of T., to extend the electricity mains, at a cost of £318, to the pumping station at Stanway for the Lexden and Winstree R.D.C.

Continental.—Spain.—Strike.—Although some minor strikes have been settled, the electricity works are still idle, and the company announces that if work is not resumed shortly it will bring 5,000 workmen from Great Britain.

On Saturday last the Government called up all reservists who are employés of the Canadian Lighting Co., and is taking steps to compel them to return to work as if on military service.

Proposed National Supply.—The Permanent Electrical Commission (a department of the Ministerio de Fomento) has been directed to report on the possibility of the construction, by the State, of a national network for the distribution of electricity.

Sweden.—A new undertaking has been formed at Stockholm by mining concerns interested in the electrical utilisation of water power, with the title Aktiebolag Berglagens Gemensamme Kraftforwaltning, the capital being £250,000.

Among the new companies formed in Sweden in connection with electricity supply, the majority intending to utilise water power, are:—The Ottervattsbackens Kraft Aktiebolag, of Bjurholm; the Harlosaortens Elektricitetsverk Aktiebolag, of Harlosa; the Bredby Elektriska Aktiebolag, of Bredby; and the Hallsta-Rimforsa Elektricitetsverk Aktiebolag, of Rimforsi, the last-named having a capital of £100,000.

Italy.—The Società Emiliana di Esercizi Elettrici is increasing its capital from 3,150,000 lire to 10,500,000 lire in order to defray the outlay connected with the construction of its hydroelectric stations at three falls in the provinces of Parma and Modena.

Dartford.—Proposed Extensions.—The U.D.C. has applied for a loan of £3,500 for cables, &c., for the supply of electricity to the Joyce Green works of Messrs. Vickers, Ltd.

Ellesmere Port.—Prov. Order.—The Mersey Power Co. has informed the U.D.C. that it intends applying to the B. of T. for an order to supply electricity to the works in the district.

Faversham.—Proposed New Plant.—The electrical engineer has reported that it is impossible to fulfil the agreement to supply electricity to J. Pollock, Sons & Co. without additional plant, and the T.C. has decided to apply for a loan for the purpose.

Gelligaer.—Proposed Joint Purchase.—The Gelligaer, Bedwellty, and Mynyddislwyn Councils are considering the purchase, jointly, of the Rhymney Valley Electricity and General Supply Co.'s undertaking.

Henley.—Proposed E.L.—It is stated that the Council is endeavouring to obtain sanction to a loan for an E.L. scheme.

India.—Bombay Electrical Schemes.—Hydro-electrical developments near Bombay, in the Western Ghauts, were described recently at a joint meeting of the British and American Electrical Institutes of Bombay, during the Engineers' Conference.

In the hydro-electric developments near Bombay, in the Western Ghauts, the highest land is at the very edge of the Ghauts, with a rapid descent toward the West, and a very gradual one toward the East. Near Lonarla this higher ground is broken in such a manner that water impounded in lakes, made by placing dams across the lower end of valleys, can be led by open duct to a fore-bay from which the down-take pipes can be taken to the power house approximately 1,700 ft. vertically below the fore-bay. This natural type of development, comprising lakes Gostling, Sydenham, and Wellington, is capable of supplying 50,000 H.P., or 135 million units, in Bombay during 3,600 hours per year.

It was realised, however, that this undertaking would be insufficient, and the Andhra project was decided upon, where water is to be drawn off near the head of the valley through the scarp of the Ghauts by means of a pressure tunnel, with suitable surge chamber, the point of draw-off being 115 vertical height above the lowest point in the river. The lake will impound 5,000 million cb. ft. of water below, and 12,500 million above, the draw-off level. This will supply 65,000 H.P. The Andhra project is well in hand, the tunnel being three-fifths driven and the foundations of the dam completed. The transmission distance to Bombay will be 56 miles.

The investigation of this project led to, and was followed by, that of the Nila Mula, the reservoir of which will be situated 30 miles west of Poona. With a development similar in character to the Andhra project, 150,000 H.P. can be produced. The surveys for this project are completed, and the grant of the concession is now under consideration by the Government of Bombay. The transmission distance to Bombay will be 70 miles.

Following the Andhra and the Nila Mula explorations, and based on similar methods of development, came the great Keya project further down the Ghauts in a southerly direction. This development is of such magnitude as to supply 300,000 H.P. day and night throughout the year. This is now under survey, and is expected to lead to the creation of a new and important industrial centre where electrochemical work on a large scale will be undertaken.—*Board of Trade Journal.*

Isle of Arran.—E.L. Scheme.—The Marquis of Graham is interested in a scheme to supply the isle with electricity.

Kilmarnock.—Year's Working.—For the year ended May 15th, 1918, the income of the Corporation Electricity Department amounted to £45,940, compared with £33,809 in the preceding year. The expenditure was £25,678, against £17,863. Capital charges absorbed £20,938 against £13,721, and there has been carried forward £5,475, against £5,626. Units generated totalled 12,763,587, against 10,002,714, of which 456,630, against 357,403, were sold for lighting; 9,962,842, against 7 619,344, for power; 362,769, against 353,130, for traction; 49,870, against 36,920, for public lighting; 691,752, against 560,360, were used on the works; 656,247, against 645,127, were used in converting machinery; and 579,247, against 423,710, were used in transformation, distribution, &c., and were unaccounted for. The maximum load recorded was 3,800 KW., against 3,250 KW. The load factor was 32·54 per cent., against 29·60. The capacity of the plant was 10,000 KW., against 4,500 KW. The generating cost per unit sold was ·406d., and the total cost was ·568d. The average price received was 1·017d.

Korea.—Water Power.—A scheme for utilising the water power of the Sampang River for the production of electricity is to be commenced during the next few months. The scheme will, in the first instance, supply power to a chemical works on that river. Generating plant will be installed in the town of Sampangli and at Sokkyoli and a total of 7,000 H.P. is anticipated. About £10,000 will be spent in electrical machinery.

Leeds.—Price Increase.—From the next meter-readings the price of electricity is to be increased from 40 per cent. to 60 per cent. over pre-war charges. The new charges will be 1·6d. per unit for power and 5½d. for lighting.

Lichfield.—Prov. Order.—The Walsall T.C. has informed the R.D.C. that it is seeking powers to extend its area of supply of electricity to include portions of Hammerwick and Burntwood, in the R.D.C.'s area.

London.—Hackney.—The Electricity Committee has recommended the B.C. to apply for sanction to a loan of £16,500 for extensions in connection with the electricity undertaking, including switchgear, £9,055; E.H.T. cables, £11,270; L.T. feeders, £5,370; motor converters, £10,300; A.C. motor, £2,630; buildings, £5,600.

The electricity mains are to be extended to Rossington Works, Rossington Street, at a cost of £200.

St. Pancras.—The B.C. is to invite plans, &c., for the erection of blocks of flats on a site in Prince of Wales Road, to contain provision for two, three, and four-room self-contained flats to have gas, electricity, and hot water services.

Lytham.—Proposed E.L.—The U.D.C. has appointed a deputation to discuss with the St. Anne's Council the question of a supply of electricity to Lytham.

Manchester.—Coal Supplies.—In reply to a statement that the electricity department could not carry on for three days in the event of a coal strike, Mr. S. L. Pearce, the borough electrical engineer, has stated that he would not anticipate any difficulty in maintaining the present output for at least a few weeks.

Monkwearmouth.—Motor-Generator Wrecked.—On February 27th a 5,000-volt motor-generator was practically wrecked at the Whickham Street sub-station. By a mistake in starting up, the generator was switched full-on immediately, with the result that one end was completely smashed. The building was damaged by the flying metal, and the wood-work of another generator in the same building was damaged, but the running of the machine was not affected, and the supply to the district was not interrupted. Nobody was injured.

Rochdale.—Extensions.—The D.R. cotton mill has asked the Corporation to arrange for a further supply of 1,500 kw. of electricity by the end of April, an additional 1,500 kw. by the end of July, and a total of 7,500 kw. by the end of 1919. The Corporation is seeking powers from the Director of Electric Power Supply to enable it to extend its plant to meet the demand.

Rotherham.—Extensions of Supply.—The borough electrical engineer has reported that in addition to the amount to be supplied to the Yorks. E.P. Co., the Sheffield Corporation, and Messrs. Steel, Peech & Tozer, there is a further demand for 16,800 kw., to be connected by March 20th, 1920.

St. Helens.—Purchase of Plant.—The T.C. has authorised the purchase of second-hand motors at the sale at the Haymarket National Shell Factory, Liverpool, at a cost not exceeding £500; also three transformers, at a cost not exceeding £950.

South Africa.—Kingwilliamstown.—The B.C. is considering a scheme for the extension of its electricity undertaking, at a cost of £25,000.—*British and S.A. Export Gazette.*

South Shields.—Price Increase.—The Electricity Committee has decided to increase the charges for electricity, except for public lighting and traction, by 50 per cent. over the rates in force in September, 1918, as from April 1st next.

Swansea.—Electricity and Housing Schemes.—It was reported at a meeting of the Electricity Committee that the cost of supplying electricity for driving haulage and other machinery in connection with the Town Hill housing scheme would amount to from £2,500 to £3,000. It was explained that the supply could be used later to light the houses, and the engineer (Mr. J. W. Barr) was instructed to confer with the Housing Committee on the matter.

Uruguay.—E.L. Scheme.—The State Electrical Board has decided to install an electric lighting service in Villa Dolores (Department of Colonia).—*Review of the River Plate.*

United States.—Survey of Power Resources.—Secretary Lane of the Interior Department has sent to Congress requests for an appropriation of $50,000 for a survey of the power resources all over the United States, and for an appropriation of $200,000 for a report on the power supply for the industrial region of the Northern Atlantic seaboard, extending in general from Boston to Washington. The request for the $200,000 appropriation has been approved by the Secretary of the Treasury.

Water-Power Legislation.—The water-power conferees of the Senate and House of Representatives have held another meeting, and are again deadlocked upon the same question which has prevented the passage of a water-power Bill for five years—namely, the question of the charge to be made. Senators insist that no charge shall be made for the use of water, on constitutional grounds, while the House conferees are insisting that a proposed Federal Power Commission shall have the right to make a charge for water.—*Chem. and Met. Engineering.*

Wallasey.—Proposed Extensions.—The Electricity Committee has applied for sanction to a loan of £90,000, for the extension of the electricity station, and the provision of new mains.

Wellingborough.—Extensions.—The Northampton E.L. and P. Co. has obtained the sanction of the R.D.C. to erect an overhead main to supply additional power at Rushden. The supply of power and light to villages en route is to be considered. The new riverside power station was opened last week, and power is to be supplied to Irthlingborough and other boot-making centres in the district.

Wigan.—Proposed Loan.—The Corporation has decided to apply to the L.G.B. for sanction to borrow £101,250 for extensions at the generating station.

Workington.—Prov. Order.—The T.C. has decided to apply for a prov. order for electricity supply.

TRAMWAY AND RAILWAY NOTES.

Australia.—Prahran.—Year's Working.—The report of the Prahran and Malvern Tramways Trust for the year ended September 30th last states that, under agreement with the Trust, the Melbourne E.S. Co. is to install two 500-kw. generators. During the year 6,546,500 units were used, at an average cost of 1·307d. The total receipts for the year amounted to £204,692, and the working expenses to £148,428. After meeting capital charges, there was a balance of £6,147. Car-miles run totalled 3,021,021, and 28,370,193 passengers were carried. The total capital expenditure at the end of the year was £793,342.

Barrow.—Proposed Purchase.—The T.C. has decided to consider a report on the question of the purchase of the tramway system in the town; the Council's option to purchase expires at the end of this month, and cannot be renewed for another seven years.

Meters.—As the Council is unable to obtain prepayment meters for certain temporary houses, it has been decided to demand a deposit of 10s.

Electric Vehicles.—The Health Committee has agreed to purchase two 3½-ton electric wagons, at £1,252 each. The Council was informed that the vehicles would cost £200 more than petrol trucks, but the cost of running by electricity would be £200 a year less.

Continental.—France.—Railway Electrification.—A further step has been taken in connection with the inquiry which is now proceeding respecting the adoption of electric traction on the railways. The Administrative Sub-Committee has examined proposals for the conversion of the systems of the Midi, Paris-Orleans and Paris-Lyons-Mediterranée Railways, comprising a total length of 5,084 miles (hydro-electric works, fixed transformer stations, and rolling stock), and representing an estimated expenditure of £96,000,000. The Technical Sub-Commission has in preparation a report recording the experience already gained in France and abroad in the electrification of main lines. This report, which is intended to facilitate a comparison of the various systems of traction in use, is to be distributed shortly. The report will serve as the basis for discussion, which, after being verified by the representatives of the Special Committee, will lead to a decision as to the best method of traction for the French main lines of railway.

Italy.—A Government decree has authorised the Società Anonima per Imprese Elettriche Piacentine to construct and work an electric tramway in the city of Piacenda.

Dewsbury.—Proposed Extensions.—The Electricity and Tramways Committee has decided to submit to the L.G.B. revised estimates for the construction of the proposed Dewsbury Moor and Shaw Cross tramways, and linking-up line, as follows:—Dewsbury Moor, £51,393; Shaw Cross, £53,486; Market Place, £2,723.

Dublin.—Tramway Manager Fined.—In the Dublin Police Court, Mr. G. Marshall Harris, general manager, Dublin United (Electric) Tramways Co., was fined 1s. for the overcrowding of a tramcar, and the conductor of the car was cautioned. The magistrate, Mr. Lupton, said the people who stood in the cars, and caused the overcrowding, were those who ought to be prosecuted.

Edinburgh.—Tramway Electrification.—In connection with the proposal for the electrification of the tramway system, when it is transferred to the Corporation, a deputation from the Tramway Committee is to visit London to inquire into the operation of the conduit system.

India.—Railway Electrification.—Two great railways which terminate at Bombay are now seriously considering the electrification of their local services and Ghauts traffic, which should result in very extensive electrical engineering applications. It is now generally admitted that existing conditions render this necessary, as a means of enabling them to cope with the increased traffic in the near future.—*Board of Trade Journal.*

Kirkcaldy.—Rail Welding.—The Tramway Committee has recommended the T.C. to purchase rail-welding plant and a motor-generator, with magnetic clutch, at a cost of £485.

Year's Working.—There was a net deficiency on the operations of the Corporation tramway undertaking, for the year ended May 15th last, of £3,356, against £3,163 in the previous year. The revenue was £11,115, against £9,201; and working expenses were £10,005, against £8,049; interest accounted for £1,863, against £1,650; sinking fund charges for £1,451, against £1,409; and depreciation for £1,160, the same as for 1916-7. Passengers carried totalled 2,990,539, against 2,483,155; 245,828 car-miles were run, against 239,296; and 362,769 units, against 353,130, were used. The total operating costs per car-mile were 9·767d., against 8·073d.; and the average revenue per car-mile was 10·88d., against 9·23d.

London Electric Railway Co.—Extension of Time.—Application has been made by the London Electric Railway Co. to the B. of T. for an order to extend the time for the construction of the tube railway from Hampstead to Edgware.

Monmouthshire.—Western Valleys.—Railless Electric Traction Act, 1913, and Extension Order, 1914. The B. of T. has extended the time for the completion of the trolley-vehicle equipment for a further period of 12 months.

Peterborough.—Proposed Light Railway.—It is proposed to construct a light railway from Kimbolton to Peterborough.

Prescot.—Proposed Purchase.—Subject to the approval of the B. of T. and the Light Railway Commissioners, the Tramways Committee has agreed to purchase the undertaking of the Liverpool and Prescot Light Railway Co., for £18,000, as from June 30th next.

Smoking on Duty.—According to the daily Press, the Commissioner of Police has been asked by the London and Provincial Union of Licensed Vehicle Workers to allow tramcar drivers and conductors to smoke while on duty, and he has promised to obtain the views of the tramway authorities.

South Shields.—Year's Working.—The annual report of the Corporation tramway undertaking shows a revenue for the past year of £51,276, an increase of £7,288 over the preceding year. The expenditure increased by £7,329, this amount including £5,000 reserved for repairs to permanent way and overhead equipment. The wages bill increased by £1,930. After providing for interest and redemption, there was a balance of £4,755, of which £4,350 has been placed to the credit of the borough rate. The Committee recommends the Council to apply for sanction to a loan of £26,000 for extensions in Mile End Road and Harton Road.

New Plant.—The T.C. has agreed to apply for L.G.B. sanction to a loan of £1,450, for the provision of four generators for charging the three municipal electric vehicles.

Stockport.—Proposed New Service.—The Tramways Committee has appointed a Sub-Committee to arrange terms with the Manchester Tramways Committee for a tramway service from Manchester to Stockport, *viâ* Reddish.

Railless Traction.—The Tramways Committee is considering the question of replacing the railless tramway system on the Offerton route by motor-'buses.

St. Helens.—Tramways Purchase.—The T.C. takes over the tramway system from the company this year, and has resolved to enter into negotiations with the company for the purchase of the company's tramcars. The Council also decided that a general manager of the tramways be appointed, and that an advertisement be issued inviting applications.

A Sub-Committee was appointed to obtain and consider information as to comparative costs of the running of tramcars, motor-'buses, electric 'buses, railless trolley-'buses, and the cost of road repairs.

Thames Valley.—Floods.—Portions of the Thames Valley are still flooded, and tramway cars were held up on Friday last at Raynes Park on the route between Tooting and Hampton Court.

Tramway Men's Wages.—At a meeting at the Ministry of Labour, on Thursday last week, between the representatives of the employers and the National Transport Workers' Federation, considerable progress was made towards a settlement. An agreement on the wages question was practically reached a fortnight before, and it is now stated that the employers submitted proposals which admitted the principle of a 44-hour week, but accompanied by certain conditions. A further meeting is to be held on March 18th.

Wakefield.—Extensions Scheme Abandoned.—A Sub-Committee has reported that, owing to the prohibitive cost of materials, the proposed tramway extensions to Alverthorpe and Flanshaw are impossible at present.

TELEGRAPH AND TELEPHONE NOTES.

Cable Delays.—According to a statement appearing in the Australian newspapers just to hand, it was stated by the Acting Prime Minister early in January that during the preceding few months the Government had been obliged to take important information from the newspaper telegrams. Government messages often took three or four days. A member of the House of Representatives said that private cable messages took as long as six weeks. Another speaker urged that better business arrangements for the dispatch of information of great value to the industrial world should be made in England, where there was a High Commissioner with a large staff.

According to the *Evening News* Mr. Hughes has cabled, informing Mr. Watt that the Marconi Co. has offered to erect full-power stations in Australia, capable of communicating with Great Britain. It is understood that an objection has been raised to competing with the Pacific cable.

Cable Repairs.—The Guam-Manila and Manila-Hong-Kong cables have been repaired. Cable communication with the Philippines, Hong-Kong, China, and Siberia *via* Commercial Pacific Cable has been restored.—*T. and T. Age.*

Canada.—A resumption of the commercial wireless service between this country and Canada is announced by the Marconi Co. Permission has not yet been given for transmission of messages to the United States.

From March 10th wireless telegrams at the full ordinary rate for places in Canada may be filed at the Marconi Co.'s offices, or at any postal telegraph office in the United Kingdom.

Spain.—Marconi's Wireless Telegraph Co., Ltd., has been authorised to establish commercial wireless communication with Spain, as from March 13th. Telegrams should be filed at the company's offices or at any postal telegraph office in the U.K. The charge per word will be 2½d., with a minimum charge of 10d. per telegram. This represents a reduction of ½d. per word on the present cable charges.

Telegraph Censorship.—The Governments of the U.S.A., Canada, and other parts of the Empire, have withdrawn their control of cable and wireless messages. All regulations concerning the censorship of wireless messages to and from ships in the West Atlantic and Pacific have been removed by Canada and the U.S.A. The same rule applies to commercial coast stations, while the restrictions regarding code and cipher messages have also been abandoned.

An agreement between the U.S.A. and Great Britain abolishes the double censorship, and telegrams in future will be censored solely in their country of origin. The new arrangement comes into force on March 13th.

Telegraph Communications Board.—The Postmaster-General in a written answer to Sir Henry Norman, states that he is aware of the steps taken by the French and American Governments in the erection of State owned high-power wireless telegraph stations in France and America. As regards the question of taking similar steps in the British Empire, he says that the War Cabinet has recently appointed a Telegraph Communications Board, with Lord Milner as chairman, whose duty it will be to consider this question as early as possible.—*The Times.*

Wireless Telegraphy.—Mr. Roy A. Weagant, chief engineer of the Marconi Co., announced at a recent meeting of the Institute of Radio Engineers, New York, that he had discovered a device eliminating "static" trouble from the operations of wireless telegraphy. The essence of the invention was founded on realisation that static waves move in a vertical direction, consequently perpendicular to wireless waves. This fact, he explained, makes possible, by a proper arrangement of electrical circuits in receiving instruments located between two aerial loops, to balance out or cancel static currents which have been received at different times in the two loops, and are, therefore, out of phase, and remain in circuits operating wireless receivers, which record incoming messages. Practice, he added, had shown elimination of static influence by the device to be not a matter of chance, but reliable and consistent. Prof. Michael I. Pupin, of Columbia University, considers the invention a distinct accomplishment and a great step forward.—*Evening Standard.*

West Indies.—Marconi's Wireless Telegraph Co. has been authorised to transmit wireless telegrams at the full ordinary rate for Bermuda, British West Indies, and British Guiana. Such telegrams may be filed at the company's offices or at any postal telegraph office in the U.K.

Wireless Telephony.—The *Morning Post* announces that Mr. Daniels, Secretary for the United States Navy, had a conversation on Tuesday by wireless telephone with a pilot flying by aeroplane from Washington to Hampton Roads, and communication was established at a distance of over 150 miles.

According to the *Daily Telegraph* plans are under way, say Marconi officials, for the installation of a wireless telephone system between London and New York.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Sydney.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

May 19th. Municipal Council. Boiler-house equipment. Specifications, on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. (January 31st.)

April 28th. Municipal Council. Power transformers. Electrical Engineer, Town Hall, Sydney.

Queensland.—March 26th. P.M.G.'s Department. Telegraph and telephone material, schedules 447/451 and 453. (February 21st.)

May 15th. Department of the Treasury, Brisbane. H.T. switchboard, storage battery and motor-generator set for the Electric Power House, Inkerman Irrigation Area, Townsville. Specifications from the Hydraulic Engineer, Brisbane.

Aylesbury.—Corporation Electricity Department. One 1,000-KW. generating set complete; two 500-KW. rotary converters. (February 14th.)

Bradford.—March 22nd. Corporation. Steel girder tramrails, tiebars, bolts, &c., copper rail bonds, &c. Mr. W. H. S. Dawson, City Engineer.

Dublin.—March 19th. B. of G. Supply of electrical fittings for three or six months. Specification from the office of Master of the Workhouse.

Ipswich.—Corporation Electric Supply Department. Pipework in connection with the new steam turbine. (See this issue.)

London.—Marceh 27th. West Ham Union. B. of G. Six months' supply of electrical fittings. Mr. T. Smith, Clerk to the Guardians, Union Road, Leytonstone, E.11.

OFFICE OF WORKS.—One 300-KW. Belliss generating set, or two 150-KW. Belliss generating sets. (See this issue.)

Warrington.—March 19th. B. of G. Electrical goods for three months. Mr. A. Bottomley, Clerk, Bewsey Chambers.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Bradford.—Tramways Committee:—

26 tramcars, complete, at £1,980 each; 52 traction motors, complete with controllers, resistances and circuit breakers, at £246 each.—Dick, Kerr and Co., Ltd.

25 tramcar trucks, at £157 15s. each.—Boving Engineering Works.

Sunderland.—Electricity Committee. Accepted on Wednesday:—

E.H.T. cable.—B.I. & Helsby Cables, Ltd.
House service meters.—Ferranti, Ltd.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, March 14th. At 5.30 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Characteristics of the Spark Discharge, and its Effect in Igniting Explosive Mixtures," by Mr. C. C. Paterson and Dr. N. Campbell.

Royal Institution of Great Britain.—Saturdays, March 15th and 22nd. At Albemarle Street, W. At 3 p.m. Lectures on "Spectrum Analysis and its Application to Atomic Structure," by Sir J. J. Thomson, F.R.S.

Royal Society of Arts.—Monday, March 17th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor lecture on "Fuel Economy," by Prof. W. A. Bone, F.R.S. (Lecture II.)

Wednesday, March 19th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "The Distribution of Heat, Light and Motive Power by Gas and Electricity," by Sir Dugald Clerk, F.R.S.

Junior Institution of Engineers.—Friday, March 14th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "A History of the Locomotive," by Mr. E. Hooper.

(North-Eastern Section).—Tuesday, March 18th. At the Mining Institute, Newcastle. At 7.15 p.m. Paper by Mr. E. F. Oakford.

National Association of Supervising Electricians.—Tuesday, March 18th. At 7 p.m. At St. Bride's Institute, Ludgate Circus, E.C. Paper on "A.C. Induction Motors," by Mr. J. M. Seddon.

Illuminating Engineering Society.—Tuesday, March 18th. At 7.30 p.m. At the Trocadero Restaurant, Piccadilly, W. Tenth anniversary dinner.

Liverpool Engineering Society.—Wednesday, March 19th. At 8 p.m. At the Royal Institution, Colquitt Street. Paper on "Welfare Work," by Mr. J. A. Davenport.

Industrial Reconstruction Council.—Wednesday, March 19th. At the Saddlers' Hall, Cheapside, E.C. Lecture on "The Functions of Government in Relation to Education," by the Rt. Hon. H. A. L. Fisher, M.P., President of the Board of Education.

Chemical Society.—Thursday, March 20th. At 8 p.m. At Burlington House, Piccadilly, W. 1. Ordinary scientific meeting.

Belfast Association of Engineers.—Thursday, March 20th. At 7.45 p.m. At the Municipal Technical Institute, College Square. Paper on "The Improvements of Towns and Houses," by Mr. P. C. Cowan.

Institution of Electrical Engineers.—Monday, March 17th. At the Chartered Institute of Patent Agents, High Holborn, W.C. At 7.30 p.m. Informal meeting. Discussion on "The Future of Trade Unions as Affecting the Engineering Industry," introduced by Mr. F. Pooley.

Thursday, March 20th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Discussion on Mr. Addenbrooke's lectures on "Dielectrics in Electric Fields."

Friday, March 21st. At 1, Wimpole Street. W. 1. At 8 p.m. Joint meeting with the Royal Society of Medicine (Electrical Section). Papers on "Some Notes on Electrical Methods of Measuring Body Temperatures," and "Some Notes on the Electro-Cardiagraph," by Mr. R. S. Whipple.

(Scottish Centre).—Tuesday, March 18th. At 207, Bath Street, Glasgow. At 7.30 p.m. Discussion on "Regulations for Arc Welding," and on the President's Address to the Territorial Centres.

(Students' Section).—Tuesday, March 18th. At 7 p.m. At Finsbury Technical College, Leonard Street, E.C. Experimentally illustrated lecture on "Oscillatory Electric Discharges," and also an "Exhibition of Ancient and Modern Illuminants," by Mr. R. P. Howgrave-Graham.

Institution of Mechanical Engineers.—Friday, March 21st. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Jig Tools and Special Machines with their Relation to the Production of Standardised Parts," by Mr. H. C. Armitage.

Electro-Harmonic Society.—Friday, March 21st. At 7.45 p.m. At the Holborn Restaurant (Venetian Chamber). Smoking Concert.

Electrical Power Engineers' Association (Glasgow Section).—Saturday, March 22nd. At the Trades House Restaurant, Glasgow. Dinner.

Manchester Association of Engineers.—Saturday, March 22nd. At the Grand Hotel. At 6.30 p.m. Annual meeting. Paper on "Development of Reinforced Concrete," by Mr. B. Taylor.

NOTES.

National Electricity Supply.—The hon. secretary of the Incorporated Municipal Electrical Association, Mr. H. Faraday Proctor, has sent a circular regarding the "Ministry of Ways and Communications Bill," to all members of Parliament, stating that the Association views with very grave concern the proposal that the future control of electricity supply be taken out of the hands of the Board of Trade and be placed under the control of the Ministry of Ways and Communications. It is inferred from an answer given recently by the Parliamentary Secretary of the Board of Trade that the Bill to give effect to the recommendations of the Electric Power Supply Committee has been drafted, and it is urged that legislation as framed on the recommendation of that Committee should proceed immediately, viz., before any decision is reached to transfer the control of the electricity supply industry to any other Ministry.

"As the consumption of coal by railways is only 8 per cent. of the total home consumption, whereas the consumption by factories is 31·8 per cent., mines 10·6 per cent., iron and steel industry 16·4 per cent., and the domestic user 18·5 per cent., the consumption of electricity by railways is never likely to exceed, say, 10 per cent. of the national electricity supply in aggregate. In view of the foregoing figures it is difficult to see how the interests of the general manufacturing community, who are by far the largest users of electricity, can be adequately protected by the proposed Ministry of Ways and Communications, whose predominating interest will undoubtedly be railways. It is therefore strongly urged that the control of the electricity supply industry should be vested in that department of the Government most closely in touch with the general trade of the country, namely, the Board of Trade. To place the future control of the electricity supply in the hands of a Ministry whose chief interests is centred in the railway system of the country would be most inappropriate, and a menace to other industrial and domestic users whose interests are many times greater than those of railways."

"Every endeavour should therefore be made on the second reading of the Bill to secure the elimination of those portions relating to electricity supply contained in Sec. 2 and Sec. 6."

A Government Rolling Mill.—An interesting article in the *Engineer* describes the Government rolling mill at Weston Grove, Southampton. Since the Armistice the mill has been employed, temporarily, on the melting of scrap metal returned from France, and is turning out, for disposal to the trade, standard Government brass ingots of guaranteed analysis. At the height of its activity it was producing 21½ million brass and 19½ million cupro-nickel cups per week, without resorting to night-shift working. The maximum number of employés was 2,200, of whom two-fifths were women. The first excavating work on the site was started in May, 1916, and by November of that year the first machines were at work. The factory has its own power station, which is situated near the shore and jetty. It contains two turbo-alternators; one set by the British Thomson-Houston Co. and the other by Messrs. Fraser & Chalmers and Messrs. Siemens. Both sets are similar, running at 3,000 R.P.M., and generating 3,000 KW. at 3,300 volts, three-phase. The turbine and switchboard attendants are women who carry out the routine duties, but, in the event of difficulty, the shift engineer is at once summoned. Within the turbine room itself is a transformer house, where the voltage is stepped down to 440 volts. There are similar stations elsewhere in the works. The L.T. current is used for lighting and driving the smaller motors; while the larger motors exceeding 300 H.P., such as those driving the sets of rolls, are operated by H.T. current. The boiler house contains five Stirling boilers fitted with under-feed stokers, and each capable of generating 25,000 to 30 000 lb. of steam per hour. The coal is supplied to the boilers from overhead concrete bunkers, fed by a belt conveyor, and in its descent is passed through automatic weighing machines. Without alteration to the grates, coke dust to the extent of 25 per cent. of the total fuel supplied to the boilers has been used quite successfully.

Industrial Foremen Visit Westinghouse Works.—On Saturday afternoon, the 8th inst., a party numbering upwards of 300 of the leading representatives and foremen of eight important engineering firms in the district were received and entertained by the British Westinghouse Co., at Trafford Park. The function was organised by the Westinghouse Foremen's Association, and enabled a specially-large number of practical engineers to foregather within the works of a large industrial manufacturing concern for the commendable purpose of mutual discussion and dissemination of ideas on matters relating to methods of production, machine tools, labour-saving devices, and works administration. Addressing the gathering, Mr. Mensforth (general manager, British Westinghouse Co.) remarked that the result of such visits was of the greatest value. He emphasised the fact that the Westinghouse Co. was not a one-product factory, but was rather a general engineering organisation. There was no other factory in Europe with the same range of production under one roof. The war had taught us the value of co-operation and team work. It was as wrong in principle to hoard knowledge as it was to hoard food. Industrial foremen had a tremendous influence upon industrial conditions. He accorded a most hearty welcome to the visitors.

After the works had been viewed, tea was served in the staff canteen, and in the evening the Westinghouse foremen entertained the visitors to a smoking concert in the Westinghouse Club, where a programme given by "The Jollies" Concert Party was heartily enjoyed.

Fatalities.—At the inquest into the death (mentioned here last week) of C. Knighton (64), a workman employed by Messrs. Howard & Bullough, at Accrington, it was stated in the medical evidence that the cause of death was syncope from heart disease, accelerated by congestion of the lungs. There was no evidence that the work that he was doing had anything to do with his death, and there were no signs of electric shock. As the note appearing in our last issue may leave a wrong impression, we may state that Mr. J. Yeadon, foreman electrician at the works, said he examined No. 21 motor after the occurrence, and found a fuse out. It was a 12½-H.P. motor at 400 volts. The fuse had been out since the previous Saturday, and this prevented the motor starting. There was no current on the switch handle, and everything was in order.

While following his employment as chief engineer of the North (Military) Camp at Ripon, on March 6th, Mr. Ernest Pogson (30), died from the effects of an electric shock received whilst trying to trace a wire in a cubicle with his left hand ungloved. His right hand was resting upon some iron framework, and one foot was on a rubber mat, but the other was not. A fellow workman immediately got the insulating switch-stick and pulled Mr. Pogson off, himself receiving a shock in so doing. The engine connected with the dynamo was running light at the time; Mr. Pogson had been asked if it should be stopped, but replied that it was all right. It was stated that the work could not be done inside the cubicle with a glove on; and that the fatality would not have occurred if the engine had been stopped. A verdict of "Accidental death" was returned.

Institution and Lecture Notes.—Society of Engineers.—At a meeting of the Society on March 10th, a paper was read by Mr. Alfred S. E. Ackermann, B.Sc. (Eng.), recording the results of 95 experiments made to determine the relationship between the horizontal pressure and the depth at any given point in clay. The main series of tests were conducted by forcing into the clay various bodies representing tapered and parallel piles, some with a blunt, and others with a pointed end, and in some of the experiments thin disks of metal were forced into the clay. Observations were made of the conditions attending each test, and the results are fully discussed in the paper.

Among the general conclusions arrived at by the author, are the following:—

For tapered bodies gradually forced into clay, the load necessary to produce a given penetration is proportional to the area of the surface of contact between the clay and the body.

Clay containing a definite percentage of water, and at a definite temperature, has a definite pressure of fluidity, and when this pressure is reached and maintained, the clay yields indefinitely as a dense viscous fluid, unless it be restrained from flowing, or caused to rise, so as to produce a statical head of clay.

For equal depths, tapered piles support a larger load per unit volume of the pile, than piles having parallel sides.

With a view to increasing the resistance of piles, they should be corrugated as well as tapered.

With a given quantity of material of which to make piles, a larger number of small piles is more efficient than a smaller number of large ones.

Pointed piles are more efficient per unit volume than blunt ones. The resistance to penetration is considerably greater, the lower the temperature of the clay.

When forcing a disk into clay, the sides of the hole do not crush in (unless a certain critical depth be attained).

Dr. Hele-Shaw, F.R.S., in the discussion, called attention to the lack of information on the subject until the publication of the paper. He considered Mr. Ackermann had done valuable work in demonstrating the existence of a pressure of fluidity for clay.

Mr. O. M. Crosthwaite showed the agreement of his and other experimenters' results with cylindrical piles with those of the author.

Institution of Electrical Engineers.—On Thursday, last week, Mr. G. L. Addenbrooke delivered the second of his lectures on Dielectrics. He said that a special container was devised to apply mercury electrodes to the surfaces of the dielectrics, his electrostatic instruments had to be developed to suit the special circumstances, special resistances were built, and standard condensers were set up. Arrangements were made to provide alternating currents of suitable wave form at frequencies from one cycle in four seconds, or even lower values, up to 400 per second, the very low frequencies being obtained by means of rotating electrodes in a dish of electrolyte with a pressure of 120 volts (R.M.S.) across it. These apparatus were completed four years ago.

Dealing with "homogeneous" solid dielectrics, he found that a high specific resistance was always accompanied by low losses in the dielectric, but the A.C. losses were always higher than the D.C. losses—especially in the case of materials of very high D.C. resistance. Drying the substances under test greatly increased the specific resistance and reduced the losses. Similar results were obtained with liquid dielectrics. Experiments were made on the effects of surface leakage; the losses were found to be far greater with A.C. than with D.C., and generally the phenomena were similar to those found to take place through the substance of the dielectric. There was abundant scope for further research in this direction.

Returning to the former subject, with homogeneous dielectrics it was always found that the A.C. losses increased with the frequency—rapidly near zero frequency, more and more slowly up to eight cycles per second, after which the increase became steadily proportional to the frequency, apparently without limit. Glass behaved like paper, celluloid, and gutta-percha in this respect. Celluloid was a very convenient substance for experiment. Experiments on capacity were carried on simultaneously with those on dielectric losses, and it was found that the capacity changed inversely as the frequency, although the dielectric constant of the material, when thoroughly dried, was proved to be constant. Large changes of capacity were always accompanied by large changes in the losses. There was no doubt that the changes were due to the presence of moisture.

On Monday evening next the first of the "informal meetings" will be held at the rooms of the Chartered Institute of Patent Agents, Staple Inn Buildings (South Block), close to No. 335, High Holborn, W.C., at 7.30 p.m. A discussion on "The Future of Trade Unions" will be introduced by Mr. F. Pooley.

National Association of Supervising Electricians.—On Saturday last a Bohemian concert was held at the Caxton Hall, attended by about 250 members and friends of the Association. An excellent musical programme was provided, and a most enjoyable evening resulted. During the evening the president (Mr. J. S. Highfield), after congratulating the members on the steady growth of the Association and its popularity with the foremen, supervisors, and managers of the electrical trades, presented the hon. sec. (Mr. C. J. Banister), on behalf of the members, with a gold watch and chain, suitably inscribed, as a token of their appreciation of his efforts since the formation of the Association.

Junior Institution of Engineers.—At a meeting at Newcastle-upon-Tyne, on the 4th inst., Mr. L. C. Grant read a paper on "Electrical Disturbances in Supply Systems." The author dealt with surging troubles and their causes; he referred to H.T. kicks and breakdowns, and also directed attention to lightning and similar troubles.

Physical Society of London.—A discussion on "Metrology in the Industries" is being arranged for the meeting of the Physical Society at the Imperial College of Science, Imperial Institute Road, South Kensington, on Friday, March 28th, at 5 p.m. Sir Richard Glazebrook, C.B., F.R.S., has promised to introduce the discussion, and it is expected that several leading authorities on fine measurements will take part. Visitors are invited to attend this meeting.

National Electricity Supply.—Mr. S. L. Pearce, chief engineer of the electricity department, Manchester Corporation, speaking at a luncheon of the Manchester Rotary Club, last week, on the Government scheme for central stations, said the problem before the country was how best to bring about a scheme of reconstruction that would enable the best use to be made of existing plant, while keeping in mind the national aspect of the question, and so avoiding too great a waste of capital that had already been spent.

Outlining the definite proposals in the Government Committee's last report, he mentioned that one of the first duties of the Commissioners would be to make a most careful survey of the country, and decide into how many areas the country should be divided. He was opposed to Government subsidies generally, but he thought that during the period of reconstruction the sinking fund might be suspended, and the payment of interest out of capital might also be sanctioned during the first two or three years. It was hoped that the Bill would be introduced soon, but a very disturbing element had crept in, because it was proposed to take the business out of the hands of the Board of Trade, which had dealt with it up to the present. He could see no argument for placing electricity under railway control, and he hoped that the efforts that were being made to secure that electricity should not be under the control of the new Ministry would be successful.

In a lecture at the Royal Dublin Society's Theatre, Dublin, Prof. Pierce F. Purcell dealt with the Irish peat resources, and described three ways in which electrical energy might be obtained from peat. He said the Irish bogs were estimated to contain sufficient peat to produce about 5,000 million tons of air-dried peat fuel, and at the present rate of consumption to last over 700 years. He estimated that the consumption of peat in Ireland was about seven million tons per annum. The amount of heat energy contained in the peat in Irish bogs was many times greater than that contained in the Irish proved coal fields.

Melting Points of Elements.—Circular of the Bureau of Standards, U.S.A., No. 35, gives a table of melting points of a large number of elements, some of which are used by the Bureau as standards for calibrating thermometers and pyrometers. Amongst the latter are mercury, −38·87; tin, 231·9; lead, 327·4; zinc, 419·4; antimony, 630·0; aluminium, 658·7; silver, 960·5; copper, 1,083·0; nickel, 1,452; iron, 1,530; platinum, 1,755; and tungsten, 3,400—all in degrees Centigrade.

The British Association, 1918.—The British Association for the Advancement of Science will resume its annual congresses this year, after an interval of two years, owing to war conditions. The gathering takes place under the presidency of Sir Charles Parsons, at Bournemouth, from September 9th to 13th.

Power Plant destroyed by Fire.—A correspondent says that fire broke out on Monday night in the power house, a 50-ft. square building at the shipbuilding yard of Sir James Laing and Sons, Ltd., Sunderland. Practically the whole of the electrical installation was destroyed.

Royalties for War Inventions.—The King has approved the appointment of the undermentioned as members of a Royal Commission to determine what awards and royalties shall be paid to inventors in respect of the use of their inventions by Government departments during the war:—Mr. Justice Sargant (chairman); Mr. Halford J. Mackinder, M.P.; Mr. Robert Young, M.P.; Prof. the Hon. R. J. Strutt, F.R.S.; Sir James J. Dobbie, F.R.S.; Mr. W. Temple Franks, C.B.; Mr. G. L. Barstow, C.B.; and Mr. A. C. Cole

Thermal Expansion of Molybdenum.—Scientific Paper of the Bureau of Standards, U.S.A., No. 332, gives particulars of the determination of the expansion of molybdenum as a function of temperature. The specimen tested was of 99·85 per cent. purity, and its density was 10·114 gm. per cm.^{3} at 15° C. The experiments covered the range between − 142 and + 305° C.; the most probable equation applicable between 19° C. and 305° C. was found to be:—

$$L_t = L_0 (1 + 5{\cdot}01\, t \times 10^{-6} + 0{\cdot}00138\, t^2 \times 10^{-8}).$$

Parliamentary.—Middlesbrough Corporation is making application to Parliament for powers to acquire, complete, and carry on the undertaking of the North Ormesby, South Bank, Normanby, and Grangetown Railless Traction Co., and to establish a Joint Trolley Vehicle Board.

Co-partnership and Profit-sharing.—The Labour Co-partnership Association is holding a series of conferences and discussions at Kingsway Hall, Kingsway. Two have already been held, and on Tuesday afternoon next, March 18th, Mr. Horace Bowden, borough electrical engineer at Poplar, will speak on "A Combination of Municipality and Co-partnership: Poplar Electricity Department." Mr. E. O. Greening deals with a "Great Paris Store," on Wednesday, March 26th; on Tuesday, April 1st, "A Printing Business" will be considered; and on April 9th, the Right Hon. C. W. Bowerman, M.P., the president, will introduce "A Combination of Trade Unionism and Co-partnership: The Co-operative Printers." All the meetings commence at 4.30.

Electric Smelting.—Mr. W. L. Morrison, plant superintendent of the Western Reduction Co., Portland, Ore., read a paper on "Electric Smelting" at a joint meeting of the National Electric Light Association and the American Institute of Electrical Engineers. Electric smelting, he said, apart from the steel and iron industry, was a new industry in the North-West. Several installations were producing ferro-manganese in some form or other. The energy used in the production of ferro-silicon was so great per ton of metal produced that a difference of 0·05d. per KW.-hour above what other manufacturers were paying, would put one out of business, other things being equal. In the case of electrical steel furnaces, a small variation per KW.-hour made very little difference, for there was used only 600 to 800 KW.-hours per ton of steel, while ferro-silicon required 7,000 to 9,000 KW.-hours per ton of metal; moreover, electric furnace steel sold at a higher price than ferro-silicon.

Manganese and chrome required very much the same kind of furnace for their production. The simplest form of furnace was the single-phase furnace, which consisted of a large pot with a terminal in the bottom, either a water-cooled iron plug or a conducting hearth of carbonaceous material. A tap hole was placed at the bottom of the lined crucible for removing the molten metal and slag. A carbon electrode was suspended in the pot, this forming the other terminal, which was movable to regulate the current in the furnace. Various modifications of this furnace were used, depending on the size of installation, the more common type being the three-phase furnace in which three or six electrodes were used.

The production of tungsten and ferro-molybdenum is carried out in a somewhat different way from that of manganese and chrome on account of their high melting points when nearly pure. The common alloys run from 70 to 85 per cent. tungsten or molybdenum.

The process for producing the ferro is almost universally carried out in a single-phase furnace, or pot, averaging from 25 to 100 KW., the commonest size being about 50 KW. The pots vary in size from 10 in. inside diameter up to 24 in., and from 24 in. to 36 in. high. The pots are placed on large terminals, either of iron or carbon material. After the operation is completed the pots are removed and new ones started.

The metal is allowed to accumulate in the pots by tapping the slag from time to time through an opening punched in the lining of the pot at the top of the metal. The ore and flux are charged into the pot intermittently after the tapping of the slag. At the end of the operation, when the pot has become too full for economic operation, it is removed and broken open, the button of metal being removed and crushed. The weight of the buttons varies from 500 to 3,000 lb.

One ton of tungsten or molybdenum requires 8,000 to 10,000 KW.-hours per net ton of metal. One net ton metallic chrome (60-70 per cent.) alloy requires 10,000 to 14,000 KW.-hours. One long ton 80 per cent. ferro-manganese requires 3,500 to 5,000 KW.-hours.

Appointments Vacant. — Lecturer in Electrical Engineering, for the Bristol University (£300, rising by £10 to £350); electrical engineer (£300), for the Clacton U.D.C. electricity undertaking; assistant electrical engineer, for the City of Peterborough electricity department; instructor in electrical installation work for training discharged soldiers and sailors (£4), for the Surrey C.C. Education Committee; managerial assistant (£500), and chief assistant electrical engineer (£750), for the Corporation of Bradford electricity department; meter room assistant (£225), for the Wolverhampton Corporation electricity department; assistant engineer (59s. 6d. and quarters), for the South of Ireland Military Hutted Camps. See our advertisement pages to-day.

The Western Australian Government (Minister of Railways) is inviting applications (which have to be sent to the Agent-General for Western Australia, 115, Strand, W.C. 2) for the appointment of Commissioner of Railways; the undertakings to be under his control include the Perth Electric Tramways, and the Government electrical works.

Educational Notes.—University College, London.—The annual report states that whereas in normal times the total number of students, day and evening, amounts to about 2,200, the number last session was 1,071. The fee revenue last year only amounted to £13,581, as compared with a normal fee revenue of between £29,000 and £30,000 a year. The financial position continues to be a difficult one, and unless further help from the Treasury is forthcoming, there will be a deficit on the College establishment account of nearly £13,000 at the end of the current session.

The report refers to the many war activities of the College, and shows that special courses have been arranged in all faculties to meet the needs of students returning from war service.

The total number of past and present members of the College who have undertaken war service now stands at 2,650; 253 have fallen in the War.

Australian Metals.—According to the Melbourne *Age*, rapid and important development of new industries in connection with zinc production in Australia is forecasted in a report furnished to the Acting Prime Minister by the Electrolytic Zinc Co. of Australasia, which, as the result of the availability of hydro-electric power in Tasmania, started constructional and investigational work at Risdon, near Hobart, in January, 1917. In March of that year the first small unit in connection with the electrolytic process for the production of high-grade zinc from Australian ores was in operation, and in January, 1918, the first larger unit, designed to produce 25,000 lb. of zinc daily, was started. It has since operated continuously. The process may now, says the report, be said to be completely established.

The industries already operated by the company at Hobart are electrolytic zinc, 12 tons daily, to be increased to 100 tons daily as soon as power is available; and zinc oxide of all grades and for all purposes. In connection with the manufacture of metallic aluminium it is anticipated that the erection of a plant to produce 4,000 tons annually will be undertaken when power is available, this material being essential in the manufacture of aeroplanes. So far £300,000 has been spent in connection with the Electrolytic Zinc Co.'s undertaking.

The *Sun* states that a local industry, which has been much helped by the war, is the manufacture by the Electrolytic Refining & Smelting Co., Port Kembla, of bluestone (copper sulphate). The industry has developed to permanency as one which can profitably supply the demand, and a plant, which will be on a parity of quality with the other departments of the works, is being constructed. This is the first copper sulphate manufactured in Australia, and the output will be sufficient for the supply of all that is needed in the Commonwealth. The company has obtained a contract to supply the post offices throughout the Commonwealth for 12 months, and also the Victorian railways.

Power Factor of Arc-Type Electric Furnaces.—In *L'Elettrotecnica* of September 25th an account was given of investigations which consisted in (1) ascertaining how the power factor varies with variation in the strength and density of the current and the potential difference applied; (2) ascertaining how the power factor varies with variation in the nature of the charge and in the furnace-bath. The following is a *résumé* of the author's conclusions:—(1) The power factors of arc furnaces depend not only on the inductive action in the circuits, but also on the physical and chemical phenomena inside the furnace. (2) In these furnaces, assuming constant cross-section of electrodes and constant potential difference applied, the power factor increases with increase in effective strength of current. (3) When the cross-section of the electrodes corresponds with effective current-strength, the power factor diminishes with increase in effective value of potential difference. (4) Assuming constant current and potential difference, the power factor varies when the cross-sectional area of the electrodes is varied and increases with increase of current-density. (5) With constant potential difference and current-density, the power factor increases with increase in the cross-sectional area of the movable electrode, *i.e.*, with increase of current employed in the furnace. (6) The potential difference being constant, the variation of power factor relative to a given variation in current-density is, within wide limits, greater with electrodes of greater diameter. (7) The power factor of the furnace (other conditions being equal) may diminish considerably when working with uncovered arc instead of with covered flame. (8) To a high power factor corresponds regular working of the furnace as regards arc stability. (9) Working with high power factors is characterised, acoustically, by quietness of the arc, *i.e.*, it generally emits a characteristic "hum," and often a sound the pitch of which corresponds to the current-frequency. (10) The power factor depends also on the values of the potential differences applied to the extremities of the internal resistances of the furnace (electrodes and bath) and to the extremity of the arc proper. It increases when (other conditions being equal) the first potential differences increase with respect to the second. (11) The power factor depends (in some cases to a considerable extent) on the nature of the furnace charge, on the nature of the bath, and on the nature of the chemical reactions going on in the crucible. Other conditions being equal, then, the power factor increases with increase in the ionising force of the charge and of the bath, and may have a very high value when chemical reactions of special character take place in the crucible.

The Transport Bill.—The Bill for the establishment of a Ministry of Ways and Communications will not be debated until March 17th, owing to important alterations in the draft, the result of strong opposition to certain features of the scheme.

The Caledonian Canal.—The *Times* states that plans for the enlargement of the Caledonian Canal are under the consideration of the authorities.

Briquetting Anthracite Duff.—Mr. C. H. Steel, of Kidwelly, has sent us the following particulars of his method of treatment of anthracite "duff":—

There are dumps of this waste coal in and around this district, of millions of tons, which can be obtained by payment of a small royalty of a few shillings per ton. In its present state it is impossible to burn it, but by a simple addition, when made into briquette form, it will burn equal to bituminous coal. The briquettes, to obtain the best results, must not exceed 4 lb. in weight. The cost of materials, less labour, should not exceed six shillings per ton; and with the cost of transport and labour it should be possible to put it on the market at a cost of under 10s. a ton. It is much better than bituminous coal in use. It does not clinker, and a "clean" fire can be made by simply raking over; the ash, which resembles wood ash, falls through the bars. It is an ideal fuel to use with forced draught, being cleaner, and having greater heating power than bituminous coal.

It will also burn in an "open grate," although the results are not so good as with a range or boiler. The binding agent can be anything. The trials were carried out with linseed meal as the "binder," which further demonstrated that it was not pitch that was burning. By using pitch, and with my briquette-making process to make the briquettes, about 7½ per cent. of pitch need only be used, although it means having special plant.

As there are vast quantities of material at hand, and more to be obtained, there are huge profits to be made, and owing to the need for economy with coal it is a national asset. If I could get someone interested who had a plant at present or who had sufficient influence to have one erected, there would be a fortune in the formula and process.

There are a great many patent fuels on the market at present, some using anthracite "duff" and bituminous small mixed; but when in the furnace the anthracite simply falls through the bars into the ashpit absolutely unburnt. I have had some experience with this kind of briquette, having been at sea and using nothing else as a fuel for nearly two years. Any manufacturer could produce a very cheap and highly efficient briquette under my process, which would capture the market.

Should any reader desire further particulars, I will be pleased to give them all details and a demonstration if requested.

Literary Style.—In an editorial on the relations between editors and engineers, the following comments are made by *Chemical and Metallurgical Engineering*:—Few engineers can write with Macaulay's clarity, Stevenson's absorbing interest, or Clemens's wit; but, indeed, where is the editor who can? And there is a lurking suspicion in the mind of the man on the job that the further up in the clouds of literary expression the writer flies, the poorer his vision of the ordinary details of making the enterprise earn dividends!

Perhaps we editors are fussing too much over nomenclature; too much horrified at the split infinitive; insisting too strongly on our individual predilections for those intangible elements of "style." The other fellow's style may be as good as ours—a shiny boot, while correct for city wear, is a poor working shoe. When we rub elbows with the busy successful engineer with a coveted store of knowledge, our sins are visited on our own heads when he declines to put it on paper "because he can't write." Ten to one, *if he would only dictate his thought to a stenographer* in the abandoned way he would word a business letter, we would find so much meat in the effort that we would gladly thresh it into shape and put the finishing literary "polish" on it without which it would not gain acceptance, even though it might add only a little to the intrinsic merit of the contribution.

The words we have italicised embody precisely the same thought that we expressed in our issue of December 14th, 1917. We are constantly meeting with the practical expert who is brimming over with information, but says he "cannot write an article." He need not write it—let him "talk" it, in the presence of a shorthand writer; we will do the rest.

Industrial Research.—In a leaflet issued by the Department of Scientific and Industrial Research, attention is drawn to the Government scheme for aiding industrial research carried out by manufacturers in co-operation. For this purpose it is necessary to form "research associations" of firms engaged in the production of similar articles. Each firm subscribing to a research organisation will have the following privileges:—

1. It will have the right to put technical questions and to have them answered as fully as possible within the scope of the research organisation and its allied associations.

2. It will have the right to recommend specific subjects for research, and if the committee or board of the research organisation of that industry considers the recommendation of sufficient general interest and importance, the research will be carried out without further cost to the firm making the recommendation, and the results will be available to all the firms in the organisation.

3. It will have the right to the use of any patents or secret processes resulting from all researches undertaken either without payment for licences, or at any rate on only nominal payment as compared with firms outside the organisation.

4. It will have the right to ask for a specific piece of research to be undertaken for its sole benefit at cost price, and, if the governing committee or board approves, the research will be undertaken.

No firm outside the organisation will have any of these rights. The documents and bulletins available for members of the organisation will not be published unless the controlling committee of the organisation decides that they shall be.

It is desirable that a Bureau of Information be set up for the industry, and if that is done each firm will receive a regular service of information, and will be able to obtain translations of foreign articles of interest to it.

The method of procedure recommended is the establishment of research companies with liability limited to a nominal sum, and working without profit. A draft Memorandum and Articles of Association have been drawn up by the department. Subscriptions to such companies will not be liable to income tax or excess profits tax. Financial aid will be given if required.

Particulars of the scheme are given in leaflets entitled "Research Association Nos. 1 to 4." which can be obtained from the department, Gt. George Street, S.W.1.

The Channel Tunnel.—Mr. Bonar Law announced on Monday in the House of Commons that he was in communication with the Prime Minister in Paris upon the subject of the possibility of immediately beginning work on the Channel tunnel. The daily Press announces that both the British and French Governments have agreed to the construction of the tunnel, and that details are being discussed by a commission in Paris, on which Sir H. Ll. Smith, of the B.O.T., is the British representative. This commission is also said to be considering the building of tunnels—as announced in these columns some months ago—under the Bosphorus and from Gibraltar, connecting Europe with Asia and Africa respectively. A general agreement appears to have been reached as to the advisability of these projects. It is said that plans are being drawn up for the Channel tunnel by the S.-E. and C. Railway Co. in conjunction with Government officials on this side, and by the North of France Railway Co. and the French Government on the French side. It is reported that the French and British Governments are desirous of exercising control, and some form of joint State finance may be adopted. This matter is before the commission at Paris, and when it is settled operations will be begun on both sides of the Channel simultaneously. In addition to the railway the tunnel will carry telephone and telegraph wires, and it is also intended to install pneumatic carrier tubes for letters and parcels similar to those used by the G.P.O. The total length of the tunnel, including the approaches, will be 32 miles, of which about 21 will be under water. It is proposed to build two tunnels, each 18 ft. in diameter, connected by cross galleries at frequent intervals, and the railway will be electrically operated. The maximum depth of water on the route is 180 ft., and it is probable that the tunnel would descend to a level of about 280 ft. below the sea's surface. It is estimated that the work could be completed in five years. The cost before the war was calculated to be 16 millions, the working expenses, £450,000 per year, and the income over 1½ millions sterling. These estimates would, of course, have to be revised under present conditions.

Sir Arthur Fell is reported to have stated that the French Government is prepared to allow the generating station to be located on this side, and, in his opinion, it would probably be situated in Kent, about 10 miles from the coast.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station Officials.—Cardiff City Council has increased the salaries of Mr. A. Ellis from £500 to £750, for his services as tramway engineer and manager, and that of Mr. C. G. M. New, deputy electrical engineer, from £350, plus bonus, to £525 per annum. Mr. Ellis's salary from the electricity department is £500.

Consequent on Mr. Babb taking up the duties of general manager to the National Electric Construction Co. at Musselburgh, Mr. R. L. McCulloch has been appointed to look after the interests of the company at Bo'ness.

Worthing Electricity Committee has recommended that the salary of Mr. Geoffrey Porter, borough electrical engineer, be increased from £450 to £500 per annum next month, and in 1921 to £525, and to £550 as a maximum in 1923.

Mr. W. Billington, of the Salford Corporation tramways department, has been appointed general manager of the

Wigan Corporation tramways, in succession to Mr. F. Buckley, who has taken over the control of the Bury undertaking. Mr. Billington is also assistant secretary of the Municipal Tramways Association.

A proposal to increase the salary of the borough electrical engineer at Barrow from £600 a year to £800 was defeated at the Town Council meeting last week.

Mr. J. D. Pember, electrical engineer for the Dartford U.D.C., has resigned.

Mr. J. H. Shaw, M.I.E.E., has resigned the position of deputy city electrical engineer at Bradford, in order to open a London office on behalf of the Davenport Engineering Co., manufacturers of cooling towers, Messrs. Hick, Hargreaves and Co., Ltd., manufacturers of condensing plant, &c., and Messrs. J. Shaw, Son & Greenhalgh, Ltd., manufacturers of high-pressure valves and boiler mountings. His business address will be at 89 & 90, Temple Chambers, Temple Avenue, E.C. 4.

General.—Mr. James Whitcher has left the B.T.H. Co. to join the consulting staff of Messrs. Kennedy & Donkin, Westminster. In his seventeen years' experience with the former firm as a leading designing engineer on main switchgear and electrical control, transmission, and distribution work, he has been in close practical touch with, and actual direction of, much of the development that has ensued in this important branch of electrotechnics; moreover, before specialising in this section, he had the advantage of ten years of responsible work in the broader ways of steam and electrical engineering, so that he is well prepared to share in the development of sound practice in the control and ditsribution of electrical energy.

Mr. G. T. McGlashan, lately chief sales engineer for Scotland, for the British Electric Plant Co., Ltd., Alloa and Glasgow, has joined the firm of Messrs. Edmiston, Brown and Co., electrical and mechanical engineers, 219, St. Vincent Street, Glasgow.

Roll of Honour.—Able Seaman H. Chew, R.N., who died in hospital at Plymouth from pneumonia, was an apprentice with Mr. Isherwood, electrical engineer, Blackburn.

Obituary.—Mr. J. P. Tierney.—There has passed away, from influenza, at Monkstown, Co. Dublin, Mr. Joseph P. Tierney, whom our correspondent describes as one of the best-known of Irish electrical and consulting engineers. He was formerly in the service of the Dublin United Tramways Co., and was the inventor of the controlled-point system. His services as consulting engineer were in great demand, and he was engaged with electric light installations in many Irish towns.

NEW COMPANIES REGISTERED.

Firth Tiertan Co., Ltd. (10,251).—Private company. Registered February 28th in Edinburgh. Capital, £2,000 in £1 shares. To carry on the business of manufacturers and dealers in rubber, asbestos, and insulating materials, &c. First directors: J. C. Sinclair, 47, Waterloo Street, Glasgow, rubber and asbestos manufacturer; F. Stevenson, Glenburn, Sheepburn Road, Uddingston Registered office: 47, Waterloo Street, Glasgow.

Rip Plugs, Ltd. (153,487).—Private company. Registered March 4th. Capital, £5,000 in 4,500 shares of £1 and 10,000 founders of 1s. each. Manufacturers of sparking plugs, importers, exporters, electrical engineers, manufacturers of devices and appliances for aerial and water navigation or progression, &c. The subscribers (each with one share) are: T. H. R. Key, 92, Kimberley Gardens, Harringay, N., engineer; A. Thomsen, 32, Cumberland Park, Acton, aeronautical engineer; E. Baumann, 32, Cumberland Park, Acton, aeronautical engineer; L. Ripault, 98, Hallam Street, W. 1, engineer. Managing director: L. Ripault. Registered office: 23, Warren Street, W.

Anode, Ltd. (153,474).—Private company. Registered March 4th. Capital, £250 in £1 shares. Electricians, electrical motor, telephone and general engineers, optical, nautical, and other instrument makers, &c. First directors: P. W. Ernest, 10, Argyle Road, Hendon, N.W.; B. R. Walter, 199, Sandringham Dwellings, Charing Cross Road, W.C. Registered office: 172, Wardour Street, W.

Flexile Metal Co., Ltd. (153,532).—Private company. Registered March 7th. Capital, £50,000 in £1 shares. Manufacturers of and dealers in tubes, casings, and containers in metal, and other substances, electrical engineers, &c. The subscribers (each with one share) are: A. W. Rogers, 17, Prairie Street, S.W. 8, clerk; Mrs. B. N. Lovitt, 11, Hornsey Park Road, N. 8. First directors to be appointed by the subscribers. Solicitors: Thorne, Priest & Co., 11, Great James Street, Bedford Row, W.C. 1.

C. H. Morse & Co., Ltd. (153,499).—Private company. Registered March 5th. Capital, £4,000 in £1 shares. Electrical, mechanical, and general engineers, manufacturers of motors, cycles and accessories, &c. The subscribers (each with one share) are: C. H. Morse, 64, Heathfield Road, Cardiff, engineer; R. J. Cuming, 108, Brunswick Street, Canton, Cardiff, engineer. Table "A" mainly applies. Registered office: 7, Exchange Chambers, Bute Docks, Cardiff.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Woking Electric Supply Co., Ltd.—Issue between February 5th and June 22nd, 1918, of £4,300 debs., part of a series already registered.

Eagle Electric Light & Power Co., Ltd. (163,514).—Private company. Registered March 6th. Capital £2,000 in £10 shares. As title. First directors: Major W. Taylor, F. Lane, R. J. Cadel, A. E. Franklin, and E. Heavens. All of Faringdon, Berks. Solicitor: A. G. Haines, Faringdon, Berks.

Munster Electric Lighting Co., Ltd.—J. Hunter, of Liverpool, ceased to act as receiver on January 31st, 1919.

Bourne End Electrical Installation Co., Ltd.—A notice of the appointment of R. M. Blaikie, of High Wycombe, as receiver and manager, on February 20th, 1919, by order of Court.

CITY NOTES.

South London Electric Supply Corporation, Ltd.

The gross receipts for 1918 were £74,827 and the expenditure was £43,881. £3,125 was brought forward, and the amount available is £34,371. There has been placed to depreciation £7,000, 6 per cent. is paid on the 6 per cent. cumulative preference shares, also debenture and other interest. £2,500 is to be put to general reserve, and, after paying a dividend of 5 per cent. for the year on the ordinary shares, £3,717 remains to carry forward. New connections added to the system are 30,032 (35-watt) lamps, or 1,050 kw., making 447,772 lamps, or 15,650 kw. Units generated 9,303,688; units sold, 7,112,252, against 7,549,945 in 1917; used on works, 389,363; expended in distribution, 1,802,073.

In June last the board addressed a letter to the shareholders embodying an offer from the County of London Electric Supply Co., Ltd., to purchase the whole or any portion of the ordinary shares of the company on the terms set out in the letter referred to. The shareholders generally availed themselves of this offer, with the result that the County of London Electric Supply Co., Ltd., became the holders of a preponderance of the ordinary share capital. The board has been reconstructed, and Capt. Bax, Mr. J. M. Henderson, Mr. F. J. Leslie, and Mr Algernon Turnor have resigned, while Mr. J. B. Braithwaite has been elected chairman, and Mr. H. B. Renwick managing director.

Annual meeting, March 18th.

County of London Electric Supply Co., Ltd.

During 1918 capital expended in London districts was £75,950. Balance from revenue, after deducting expenses £179,490, plus £15,023 brought forward. Debenture and loan interest absorb £43,455; to reserve for depreciation, &c., £50,000; to reserve for deferred maintenance £15,000; written off preliminary expenses £5,000. Dividend on the preference shares 6 per cent. for the year; final dividend of 9 per cent., less tax, making 7 per cent. for the year, on the ordinary shares. To be carried forward, £15,516. Two of the original directors, Messrs. F. W. Reynolds and A. H. Sanderson, have died, and Mr. J. Shaw has resigned. Sir W. Guy Granet and Mr. J. Atherton have been appointed directors.

With a view to assisting in the further co-ordination of the electric supply of London, the directors in June last made an offer to the shareholders of the South London Electric Supply Corporation, Ltd., to exchange their ordinary shares on certain terms for ordinary shares of their company. The shareholders of the South London Co. largely availed themselves of this offer, and 10,578 ordinary shares of the company were issued accordingly. The South London Co.'s power house has been connected up with the Wandsworth power house, and considerable economies are resulting from the closer union of the two companies.

At the annual meeting, on March 17th, sanction will be asked to an increase of preference and ordinary capital, with a corresponding increase in borrowing powers. Applications received during year, 4,560 kw., making 73,692 kw. Units sold, 40,326,263, an increase of 2,731,002. Consumers increased from 27,998 to 28,400. The results obtained during the year are again satisfactory. The cost of coal, wages, and materials has still further increased. The S. London Electric Supply Corporation has declared 5 per cent., and the Bournemouth & Poole Co. 5 per cent. The units sold by the Cottbridge & Airdrie Electric Supply Co., Ltd., increased from 10,072,535 to 11,469,820. During the war 482 of the employés of the County and associated companies have been on service. Thirty men have been killed in action and 51 wounded.

City of London Electric Lighting Co., Ltd.

The report for 1918 states that the capital expended was £4,931, and £5,524 was written off in respect of buildings, plant, and works dismantled. Total revenue £389,859; less expenditure £248,252, leaving £141,607, plus £17,573 brought forward. Interest on loans and debenture stock £25,346; interest transferred to debenture stock premium redemption account £1,701; leasehold redemption account £330; employés' provident and benevolent funds, &c., £1,616; special contribution to benevolent fund £2,500; stores written down £329; transferred to reserve account £50,000; preference dividend 6 per cent.; ordinary dividend 8 per cent.; carrying forward £20,019. The increase in gross revenue is £38,673 over 1917. Net revenue advanced by £7,627. The average price obtained per unit sold for private supply was 3.27d., against 2.61d. in 1917. Units generated 31,731,491, against 35,375,929 in 1917. Units sold 26,656,655, against 29,697,392 in 1917. Maximum supply demanded 18,900 kw. in 1918, against 20,910 in 1917. Units sold for power 10,900,690; heating 3,893,447, together equal to 57.96 per cent. of the total units sold for private supply. Annual meeting, March 19th.

Bruce Peebles & Co., Ltd.

The profit for 1918, including interest on investments and transfer fees, and after deducting administration expenses, the amount required for debenture service and provision for excess profits duty, amounts to £15,657. Of this, £6,000 has been applied to depreciation reserve account, and £976 has been written off preliminary expenses. The preference dividend of 7½ per cent., less tax, requires £3,830, and a further dividend at 2½ per cent. per annum for the year, less tax, making up the full dividend of 10 per cent. in terms of the scheme of arrangement, requires £1,277, leaving £3,574 to be carried forward. Effect has been given in the balance sheet to the scheme of arrangement for the reorganisation of the company's capital approved at meetings of first mortgage debenture holders, unsecured debenture holders and shareholders, held in February last and confirmed by the Court. The balance of profit and loss account at

December 31st, 1917, amounting to £15,827, has been included in a suspense account, to which has also been added the provision made for excess profits duty for the current year. The excess profits duty in respect of the years 1917 and 1918 will be charged against the suspense account when finally ascertained. A new workshop, 200 ft. long, 65 ft. span, has been erected during the year, and provided with the requisite plant to cope with the satisfactory and increasing demand for heavy steel works plant which the company is now manufacturing. Annual meeting, Edinburgh, to-day.

Charing Cross, West End & City Electricity Supply Co., Ltd.

The report for 1918 shows the following results:—

West End Undertakings.—Gross earnings £193,858, against £165,136 in 1917. Expenses, excluding depreciation, £132,946, against £103,268 in 1917. Net earnings £60,912, against £61,869. Including £8,258 brought forward and £4,794 interest accrued, £73,992 is available. Interest on debenture stock, £17,829; depreciation, £22,000; preference dividend, £18,000; ordinary dividend, 4 per cent., £16,000; leaving £162 to be carried forward. Connections to West End mains 753,052 (30-watt) lamps; lighting, 460,449, heating 64,566, power 228,037 (9,170 H.P.). Units generated, 1,515,174; bought, 15,276,229; sold, 11,590,966; used on works and lost, 5,200,437.

City Undertaking.—Gross earnings £238,075, against £212,542 in 1917. Expenses £199,250, against £147,153. Net earnings £38,825, against £65,388. Including £18,000 brought forward, £56,825 is available. Interest on debenture stock, loans, and advances, £29,750; preference dividend, £18,000; leaving £9,075 to be carried forward. Connections to city mains, 807,443 (30-watt) lamps; lighting, 327,198; heating, 99,592; power, 380,653 (15,307 H.P.). Units generated, 36,595,375; sold, 29,985,073; used on works and lost, 6,610,302. Annual meeting, March 20th.

Underground Electric Railways Co. of London, Ltd.

There was a good deal of criticism of the board at the annual meeting last week on the question of reserves, but the chairman, Lord George Hamilton, took up a very definite attitude. Referring to the policy of the operating companies in making reserves for depreciation and renewals, he said that in the difficult years ahead of them they could not hope to maintain their present position unless their financial reserves were adequate for the rehabilitation of permanent way, and for making good the wear and tear of their electrical plant and the necessary replacements of the rolling-stock. No boards could accept the responsibility of directing their companies if outside interference had the power of curtailing the maintenance of the reserves necessary for the continuous working of their enterprises. On this point they were not prepared to make any concession. Sir Robert Perks and others objected to the large sums paid to reserve, which they thought was already in excess of reasonable requirements, while so much of the capital went without a return. The chairman said that the board were not going to give up their power of putting to reserve what they considered necessary to protect the company's interests, and if the 6 per cent. income bondholders thought they had a good case they could take the matter to the courts.

Oxford Electric Co., Ltd.—Sir Henry Mance stated at the annual meeting that the wages bill was now 100 per cent. higher than it was before the war. Coal had had the most adverse effect upon their returns for the year, and its price was possibly to be raised by another 30 per cent. If that advance should be made the company would have to put up their charges proportionately. They hoped that the Government would withdraw as soon as possible the order for restricting the consumption of electric current, and representations were being made to them for that purpose. The colleges were now resuming their normal life. At present he saw no reason to fear that the company would be prejudicially affected by any electricity supply measure the Government might adopt.

Bournemouth and Poole Electricity Supply Co., Ltd.—The revenue balance, after deducting generating and distribution costs and other charges, is £32,461, plus £2,079 brought forward. Debenture and loan interest, less tax, absorbs £7,791; leasehold and special redemption funds and interest, £2,221; to reserve for depreciation, &c., £8,000. The dividends on the ordinary shares amount to 5 per cent. for the year, and £1,299 is carried forward. Two directors, Messrs. A. H. Sanderson and F. W. Reynolds, have died. Mr. J. A. Hosker is now chairman, and Mr. H. B. Renwick, deputy chairman. Applications received at December, 12,596 KW., an increase of 425 KW. Units sold, 4,513,956.

British Insulated and Helsby Cables, Ltd.—The directors recommend a dividend of 8¾ per cent. (1s. 9d. per share) on the ordinary shares for the past half-year, making 12½ per cent. for the year on the revised capital, place £80,000 to reserves and depreciation, and carry £99,000 forward. Last year, 7½ per cent. and a bonus of 10 per cent., making 25 per cent. for the year, were paid on the old capital; £248,500 was added to reserves, depreciation, &c., and £84,792 carried forward, after providing for estimated excess profits duty. One new fully-paid ordinary share was afterwards allotted for each ordinary share held.—*Financial Times.*

Davis & Timmins, Ltd.—Net profit for 1918, including £32,013 brought forward, after allowing for depreciation, &c., and excess profits tax (1917), £77,659. There is put to general reserve £2,000 and to income tax account £7,919. The dividend on the ordinary shares totals 8 per cent. for the year (free of income tax), also a bonus of 17 per cent. out of the profits (free of income tax). There is carried forward, subject to special taxation, £52,389.

Automatic Telephone Manufacturing Co., Ltd.—Profit for 1918 £41,331, plus £11,550 brought forward. After writing off £8,000 for depreciation, and paying 6 per cent., less tax, on the ordinary shares, £11,281 is to be carried forward.

Gandy Belt Manufacturing Co., Ltd.—Dividend 17½ per cent. for the half-year on ordinary shares, making 25 per cent. for 1918.

Globe Telegraph & Trust Co., Ltd.—Interim dividend on ordinary shares 2s. per share, free of tax.

Direct West India Cable Co., Ltd.—Interim dividend on the ordinary shares at the rate of 6 per cent. per annum, free of tax, for the past half-year.

Halifax and Bermudas Cable Co., Ltd.—Interim dividend on the ordinary shares at the rate of 6 per cent. per annum, free of tax, for the past half-year.

Edison Swan Electric Co., Ltd.—The company in meeting on March 10th confirmed the resolutions altering the articles, bearing upon the new issue of capital.

Ransomes, Sims & Jefferies, Ltd.—Dividend on ordinary shares 8 per cent. per annum, free of tax, leaving £41,437 to be carried forward.

Clones Electric Light & Power Co., Ltd.—Net profit £296. Notwithstanding great reduction in current consumption, revenue increased by £202 over the preceding year. Dividend 5 per cent.

Llanelly and District Electric Lighting & Traction Co., Ltd.—Dividend on the ordinary shares 5 per cent., less tax; to reserve and renewals, £4,000; carrying forward £2,057.

Western Telegraph Co., Ltd.—Second quarterly dividend 3s., free of tax, at the rate of 6 per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange securities are roughly gradeable into one class where labour troubles enter, and another class into which they do not. These categories take the place of the labels "Peace Stocks" and "War Stocks" that prevailed at armistice-time. The present movement of investment is all in favour of colonial and foreign securities, all against the domestic variety. From various parts of the country the same tale comes, from the North of England, the Midlands, the South-Western and Welsh Counties, "Sell industrials," meaning shares in home companies. Iron, coal, steel, armament *et hoc genus omne*; railway stocks, ordinary and fixed-charge; anything, it little matters what. So does the cloud of the strike-fear lower over the Stock Exchange markets.

Electric lighting companies are scarcely affected. This seems the more singular in that the spring dividends do not make a very exciting list. It must be admitted, of course, that they are better than might have been expected, and something of a decline in prices took place in advance. On the whole, however, the market is not at all a bad one. Shareholders, so far as can be judged, take the view that their affairs can hardly get worse than was the case during the war, and that recent reports, fortified by intelligent anticipation, afford encouragement for the future.

The directors of the County of London Electric Supply Co. state in their report, just out, that they feel "the results obtained during the past year are again satisfactory. The cost of coal, wages, and material has still further increased during the year. Total units sold during the twelvemonth were well over forty millions, an increase of 2,731,002 units as compared with 1917. Net profit, before deduction of debenture stock interest, came to £179,400, an advance of £26,000. The dividend for the year is again 7 per cent. Holders of South London Electric ordinary largely availed themselves, the report states, of the offer to exchange, on certain terms, into the County of London Co., and 10,158 County ordinary shares were accordingly issued. Sanction is to be sought at the forthcoming meeting to an increase of the company's preference and ordinary share capital, with corresponding additional powers for borrowing.

The Charing Cross report shows net earnings of £60,912, being less than £1,000 below those of last year. The dividend, as already stated, is 4 per cent. The City of London Co. has £77,400 to dispose of, a decrease of £500, and the dividend remains at 8 per cent. The shares are 5s. lower on the week. Good expansion is shown on the power side of the company's business. Kensington and Knightsbridge has reduced its dividend from 7 per cent. to 6 per cent., although the year's income is only about £400 down as compared with 1917. South London has done well, its disposable balance of £21,000 being £300 better than last year's.

The Para Electric Railways & Lighting Co. shows a drop of nearly £20,000 in net revenue, to £141,000, but exchange came to the rescue, and the dividend on the ordinary shares is maintained at 7 per cent. for the year. The price is 5⅜, and the 6 per cent. preference 4¼.

Marconis are a better market on the re-establishment of wireless communication with Canada and the West Indies. The price has risen to 4¾, and brisker business than for some time past is apparent in the shares. Americans have rallied to 30s., Canadians to 16s., and Marconi Marines to 3¾ bid.

The cable group is steady, the usual demand for Eastern stocks and shares being the only feature. A reaction in Telegraph Constructions lowered the price £2. Some few shares came in on the big rise that had taken place, which induced some holders to sell prior to the re-arrangement of the capital. The British Insulated & Helsby Cables report, first since the doubling of the shares, shows a dividend of 12½ per cent., which is at the same rate as the 25 per cent. declared a year ago on the old amount of capital.

Calgary Power common shares have risen several dollars to 31. Various other American Utilities are advancing in price. The Mexican group has halted, exhibits rather a tendency to ease off, bullishness having subsided for the moment, pending next developments. Brazilian Tractions are better, and Rio de Janeiro Tramways bonds of both classes have improved.

Nobody has a good word or a spare hundred pounds for Home Railway stocks. Districts are lower at 25. A seller of Metropolitan Surplus Lands stock found no better bid than a point below the bottom price officially quoted. Underground Electric shares are duller. Amongst industrials, the weakness of armament and all the iron and steel shares is a feature, for the reasons already discussed above.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price March 11, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7⅞	—	£6 15 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	3⅝	—	6 13 4
Chelsea	3	5	3⅞	—	4 1 1
City of London	8	8	12½	— ¼	6 8 0
do. do. 6 per cen Pref.	6	6	10⅝	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10⅝	—	5 18 5
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1½	— ⅛	Nil
do. do. 6 per cent. Pref.	4	5	8¾xd	—	6 13 4
Metropolitan	3	4	3½	—	7 8 0
do. 4½ per cent. Pref.	4½	4½	8¾	—	6 18 6
St. James' and Pall Mall	8	9	7⅞	—	7 0 4
South London	5	5	8	—	6 13 4
South Metropolitan Pref.	7	7	20/8xd	—	6 16 7
Westminster Ordinary	7	9	6½xd	—	6 13 4
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	96½	—	6 1 10
do. Def.	1½	1½	21⅞	—	7 13 0
Chile Telephone	5	5	7⅞	—	5 6 8
Cuba Sub. Ord.	7	7	11	—	*6 7 4
Eastern Extension	8	8	16	+ ⅛	*5 0 0
Eastern Tel. Ord.	8	8	*16⅛	+ ⅛	*4 19 6
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 7
do. Pref.	6	6	10⅝	—	5 14 8
Great Northern Tel.	24	22	32	—	6 17 6
Indo-European	13	13	58	—	5 12 0
Marconi	15	20	4⅜	+ ⅛	4 4 2
Oriental Telephone Ord.	10	10	2⅜	—	4 0 0
United R. Plate Tel.	8	8	77	—	*5 1 7
West India and Panama	6d.	1/3	1½	— ⅛	*3 15 0
Western Telegraph	8	8	16⅛	+ ⅛	*4 14 10
Home Rails.					
Central London Ord. Assented	4	4	63½	—	6 6 0
Metropolitan		1	28	— ½	4 9 3
do. District	Nil	Nil	25	— ½	Nil
Underground Electric Ordinary	Nil	Nil	8⅛	— ⅛	Nil
do. do. "A"	Nil	Nil	9/8	—6d.	Nil
do. do. Income	6	4	93	—	*5 7 6
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅝xd	—	6 11 4
Anglo-Arg. Trams. First Pref.	5½	5½	8½	— ⅛	—
do. do. 2nd Pref.	5½	—	8⅛	—	—
do. do. 5 Deb.	5	5	70½	—1	6 19 10
Brazil Tractions	—	—	55	+2	—
Bombay Electric Pref.	6	6	10⅜	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	63½	—	7 17 8
do. do. Preferred	Nil	Nil	44	—	Nil
do. do. Deferred	Nil	Nil	42	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	64	—	Nil
do. 6 per cent. Bonds	Nil	Nil	53	—	Nil
Mexican Light Common	Nil	Nil	39	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	69	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	87½	—	8 17 6
British Aluminium Ord.	10	10	1¾	—	5 6 8
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅛	—	6 3 0
Callenders	20	25	10⅜	—	5 19 1
do. 6½ Pref.	5	5	3⅛	—	6 3 10
Castner-Kellner	22	20	8⅝	—	6 1 8
Edison-Swan, "A"	—	—	19/-	—	—
do. do. 5 per cent. Deb.	4	4	74½	—	6 14 8
Electric Construction	7½	10	1⅝	—	8 0 0
Gen. Elec. Pref.	6	6	10⅜	—	6 6 10
do. Ord.	10	10	17⅝	—	*5 14 3
Henley	25	25	2⅞	—	5 8 2
do. 4½ Pref.	4½	4½	4xd	—	5 12 6
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	10	—	6⅛	— ½	*3 2 0
Telegraph Con.	20	20	54½	—2	*4 8 1

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, March 12th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	1/5	..
a Ammoniac Sal per ton	£80	..
a Ammonia, Muriate (large crystal) "	£78	..
a Bisulphide of Carbon "	..	..
a Borax "	£48	..
a Copper Sulphate "	£47	£3 dec.
a Potash, Chlorate per lb.	1/9	..
a " Perchlorate "	1/9	..
a Shellac per cwt.	£12 10s.	£1 dec.
a Sulphate of Magnesia per ton	£15	..
a Sulphur, Sublimed Flowers "	£38	..
a " Lump "	£55	..
a Soda, Chlorate per lb.	11d.	..
a " Crystals per ton	170/-	..
a Sodium Bichromate, casks per lb.	..	..
METALS, &c.		
c Brass (rolled metal 2' to 12' basis) per lb.	11⅛d.	1d. dec.
c " Tubes (solid drawn) "	1/3½ to 1/8	..
c " Wire, basis "	1/-	1d. dec.
c Copper Tubes (solid drawn) "	1/4½	½d. dec.
g " Bars (best selected) per ton	£118	£4 dec.
g " Sheet "	£118	£4 dec.
g " Rod "	£118	£4 dec
d " (Electrolytic) Bars "	£81	£9 dec.
d " " Sheets "	£161	..
d " " Wire Rods "	£91	£9 dec.
d " " H.C. Wire per lb.	11½d.	1d. dec.
f Ebonite Rod "	8/-	..
f " Sheet "	2/6	..
n German Silver Wire "	2/6	..
h Gutta-percha, fine "	11/-	..
h India-rubber, Para fine "	2/4½	1d. dec.
i Iron Pig (Cleveland warrants) per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual. "	£40	..
g Lead, English Pig "	..	..
g Mercury per bot.	Nom.	..
e Mica (in original cases) small per lb.	9d. to 4/6	..
e " " " medium "	5/- to 10/-	..
e " " " large "	12/6 to 25/- & up.	..
d Silicium Bronze Wire per lb.	1/3½	½d. dec.
r Steel, Magnet, in bars per ton	..	..
g Tin, Block (English) "	£224	..
n " Wire, Nos. 1 to 16 per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
r W. F. Dennis & Co.

The Sphere Photometer.—In the course of the discussion on Mr. A. P. Trotter's paper on "Photometric Apparatus," at the meeting of the Illuminating Engineering Society on December 19th, Mr. J. W. T. Walsh referred to the use of an integrating photometer in the form of a cube at the National Physical Laboratory for the investigation of the candle-power of large carbon arcs. He said that in the case of a source of light of non-uniform distribution, an error of the order of 10 or 15 per cent. might result from the use of a cube instead of a sphere, but with care it was possible to obtain fairly accurate measurements With the aid of a large metal-filament lamp, with a shade of hemispherical shape behind it, which gave a polar curve almost identical with that of the ordinary carbon arc (except at the central point) it had been found possible to determine the total candle-power of the arc with a single measurement in a cubical photometer, and the cube was much more convenient in use than the sphere. Mr. C. C. Paterson said that at the N.P.L. it was believed that the errors of the sphere were quite, as large as those likely to occur with a cube, and he would expect to get quite as accurate results from the latter. He did not believe the total error would exceed 2 or 3 per cent. Mr. L. Gaster pointed out that in the United States a hemisphere had been employed instead of a sphere; the method was said to prove more accurate than the use of a sphere, and had the advantage of free ventilation. Mr. Walsh further stated that the cube measured 2 m. inside.

Women War Workers.—The extent to which women replaced men in industry and commerce during the war, is disclosed in a White Paper issued on March 5th. After making necessary allowances, it is estimated that over a million and a half came forward to take the place of men. The position in April, 1918, is shown by the following figures:—

	No. employed, July, 1914.	Increase, April, 1918
Electricity, gas and water (municipal) ...	600	4,000
Tramways (municipal)	1,200	18,000
Tramways (company)	200	5,800
Other occupations	3,274,000	1,504,200
Total	3,276,000	1,532,000

COAL MINING NOTES.

Notes from the General Report of H.M. Chief Inspector of Mines.

PRODUCTION.

FROM the recently-issued report of H.M. Chief Inspector of Mines for the year 1917 we learn that the total value of all minerals raised in the United Kingdom amounted to £223,963,986, an increase of £9,929,462 as compared with the year 1916. The total output of coal was 248,499,240 tons, and the value £207,786,894, showing a decrease in the output of no less than 7,876,126 tons and an increase in the value of £7,772,268 on the figures for 1916. The average price of coal was 16s. 8·68d. per ton in 1917, as compared with 15s. 7·24d. in 1916. These figures show the very great importance of the coal industry to this country; but it must be remembered that these values are more or less artificial, due to a great extent to the unpatriotic demands of the miners for high wages, when the nation was struggling for life in the midst of a great and terrible war, and not under ordinary competitive commercial conditions.

Increased values mean increased wages, and—this is the lamentable part—increased wages mean a reduced output under such conditions. Ordinarily, under a fair competitive system, this would, to some extent, remedy itself, as the high wages would attract labour; but, with all the best manhood of the kingdom in the British Army, there was no chance of this, and the nation was practically at the mercy of a few revolutionary malcontents.

It has, however, been a well-known law in the mining industry that as wages rise, output reduces, and to show the seriousness of this for the year 1917, not only was the output less by nearly 8,000,000 tons, but it was this much less in spite of the fact that there were 23,277 more persons employed in 1917 than in 1916. Altogether there were 2,814 coal mines at work, employing 811,510 males underground and 198,783 males and 11,047 females above ground. These figures are just now most interesting to the community in view of the threatened strike of the miners for a 30 per cent. increase of wages, and a reduction in the hours of work from eight to six. Much of the lost time is avoidable, and it would be most interesting to know what effect the granting of the "minimum" wage has had on the industry. Probably a fair estimate would not be less than 20 per cent. A 30 per cent. increase in wages and a reduction in hours from eight to six would result in an advance in the price of coal by at least 50 per cent., owing to the great reduction of output. It is useless for the miners' leaders to protest against facts such as these. They know perfectly well—the higher the wages, the more the lost time; the shorter the hours, the less the output; a minimum wage, less exertion. These are incontrovertible facts, which any colliery manager in the country will unhesitatingly confirm. Possibly some little improvement could be made in the use of machinery, but this requires capital; and with an old colliery, who is going to invest more capital in an undertaking which may prove unprofitable at any time, and more especially in times like these? In any case, the miners have never given any encouragement to the owners to introduce machinery, but on many occasions have been particularly hostile. Mr. Smillie has a bad case, and no one knows that fact better than himself; the miner is as well paid as, if not better than, the worker in any other industry, and we question if it is more dangerous than other occupations. The death rate from accidents in mines was 1·50 per 1,000 in 1917, which figure is also the average for the ten years 1908-17. The miners would have the public believe that accidents are caused by wilful neglect or inattention by the owners and management of the mines. On this point the Chief Inspector reports:—"The annual reports of the Inspectors of Mines regularly show that a great number of accidents are due simply and solely to carelessness, inattention, and want of thought. There is no doubt that a large reduction in the number of accidents would result if managers, officials, and workmen in and about mines were determined that avoidable accidents should be prevented, and would co-operate in taking steps necessary to prevent them." Unfortunately, many British workmen take little or no interest in their trade or work, and efficiency is the last thing they think of. Labour without the use of intelligence never produced anything beyond the bare necessities of life, and for the workman or labourer to expect to receive the proceeds of the intelligent worker's thought and exertions, is to rob the latter of his just due, and to put a premium on idleness.

The quantity of coal exported was 34,995,787 tons. Of this, France received over 17½ million tons, Italy over 4 million tons, Malta nearly 1¾ million tons, Egypt over 1½ million tons, Gibraltar nearly 1¼ million tons, Russia over 1 million tons, and Norway over 1 million tons. 3,504,722 tons were exported in the form of coke and manufactured fuel, and 10,227,952 tons were shipped for the use of British and foreign steamers engaged in foreign trade, making the total quantity of coal which left the country 48,728,461 tons, as against 55,001,113 tons in 1916.

The amount of coal remaining for home consumption was 199,770,779 tons, or 4·725 tons per head of the population. 40,981,757 tons were used in the manufacture of coke and briquettes, and 2,816,318 tons of coal, with 10,961,734 tons of coke (equal to 18,269,557 tons of coal) in the blast furnaces for the manufacture of pig-iron, as against 39,384,879 tons, and 19,780,690 tons respectively in the previous year.

The value of other minerals (at the mines or quarries) amounted to £16,177,092, the chief of which were iron ore, limestone, clay, shale, salt, oil shale, igneous rocks, tin ore, sandstone, and slate. The values of the metals obtained by smelting from ores mined in the British Isles were as follows:—

Antimony (from lead ore)...	2	tons	£170
Copper	187	,,	25,141
Iron	4,688,063	,,	43,271,614
Lead	11,250	,,	337,500
Silver	75,472	oz.	12,854
Tin	3,936	tons	935,407
Zinc	2,735	,,	142,699
Total... ...			£44,725,385

Of tungsten ores, 205 tons 1 cwt., valued at £35,381, were obtained from mines and open workings in Cornwall, 32 tons, valued at £3,572, from mines in Cumberland, and 4 tons, valued at £789, from mines in Devon. The average percentage of metal contained in the dressed ore from Cornish mines was 62·75. This is nearly 150 tons less output than in the year 1916. It is to be hoped that this valuable mineral will increase rather than decrease in output.

The Kent coalfield produced 255,583 tons, being an increase of 46,960 over the year 1916, the value of which was £236,412.

Federation of German Technicians.—One of the results of the German revolution has been the formation of a Federation of Technicians, which recently held a Congress at Eisenach, when for the first time on record, technical men of all shades and classe assembled to further the objects of the Association. Among thos present were Herr Strecker, of the Imperial Post Office, and repre sentatives of the Association of German Engineers, the Electrotechnical Society, the Chemical Association, and of the Society of Architects, railway technical officials, and foreman engineers, &c. The objects of the combination are to assist in the reconstruction of German industries, develop technical education, advise the Foreign Office in connection with the Peace conditions, participate in Parliamentary life (technical men are said to have increased 14-fold in the new Parliament), and to become members in connection with the work of local authorities.

WELDING AS A PROCESS IN SHIP CONSTRUCTION.

By COMMANDER S. V. GOODALL, R.N.

(*Abstract of paper read before the* American Institute of Electrical Engineers, *February 19th*, 1919.)

During the war economy of time in the production of all that was needed to terminate hostilities successfully was of paramount importance. Economy in first cost and maintenance was relatively unimportant.

Now that hostilities have ceased, economy in first cost and maintenance becomes once again of primary importance, economy of time and labour being of value only in so far as it results in cheaper production. This is particularly true of shipbuilding. Every shipbuilder should now carefully review the various items of cost in the production of a ship, and while he may devote his energies to a reduction all round, he will, if he be wise, give greatest attention to a reduction in the cost of the most expensive of those items. Riverting is the most expensive item. It has been estimated that the labour cost of riveting is about 40 per cent. of the total labour cost of building the structure of a steel cargo carrier, while the labour cost of shopwork on structural material is about 15 to 20 per cent. During the past few years considerable attention has been given to improvements in shopwork, and it is unlikely that much economy can be effected in this direction. Can anything be done to lower the cost of riveting? The advocates of welding reply "Yes, by a wide substitution of welding for riveting." This is a claim that should not be lightly placed on one side, but carefully and critically examined by all shipbuilders.

Gas welding has been used in shipyards for many years, resulting in economy in the production of staple angles and similar smith's work. It has found a wide field in the construction of light fittings, being more particularly of value for thin work than for heavy plating.

It is very well known that electric welding has been of great value on repair work, particularly during the war. Ships that would otherwise have been laid up for weeks while new castings were obtained, old plates removed and replaced by new, &c., have been rapidly repaired and returned to service.

The Classification Societies have sanctioned the use of electric welding for a considerable amount of work of little importance so far as structural strength is concerned. The Welding Committee of the U.S. Emergency Fleet Corporation has found by actual experience that a labour saving of at least 60 per cent. results from the substitution of arc welding for riveting on these minor parts of a ship, and Mr. J. H. Anderton has estimated that a saving in time of 70 per cent. was effected at Hog Island.

Lloyd's Register of Shipping is prepared to classify an electrically-welded vessel, subject to the notations "Experimental" and "Electrically Welded," and provided the builders conform with certain rules. This decision was reached after an extensive and exhaustive series of trials. An electrically-welded ship is now under construction at Cammell Laird's, England, to be classified by Lloyd's, who have approved the employment of the Quasi-Arc Co.'s system in its construction. This is a small vessel about 150 ft. long, with plating generally $\frac{3}{8}$ in. to $\frac{1}{2}$ in. in thickness.

Electric welding work carried out by the British Admiralty has been described in a paper read by the author before the Engineers' Club of Philadelphia in July, 1918. Since that time valuable experience with this work on service has been obtained. The arc-welded barge has been satisfactory. The cost of material, electric current, and labour for this vessel was £301, as compared with £389 5s. for the cost of riveting, caulking, and drilling on a similar barge constructed at the same yard. The vessel was designed to be rivetless as a demonstration of arc welding; it was found that greater economy would result if certain parts, such as beams to frames, floor plates to angles, &c., were riveted.

As the plating of this barge is thin, and stresses to which it is subjected are not comparable to those which a large seagoing ship is called upon to withstand, greater interest is attached to experience with other British ships in which arc welding has been employed by the Admiralty, particularly to those where the work has been comparatively heavy. Failures of welded joints have been reported, although the number of such failures has not been large considering the amount of work that has been done, the lack of experience, the dearth of skilled operators, and the radical change in method. The Admiralty authorities, however, consider it wise, pending further experience, to defer the adoption of electric welding for those parts of the structure subjected to high complex stresses, unless the work can be so tested as to demonstrate exactly that such stresses can be safely carried.

Lap welding has been more satisfactory than butt welding, and the latter has been, for the present, discarded for all important work where the plating is $\frac{3}{4}$ in. or more in thickness. It is hoped that this situation will not last long, for it is in butt welding that the greatest gain from the use of this process may be expected, and lap joints necessitate a certain amount of overhead welding which is difficult and unreliable.

While the above briefly sums up the present position of electric welding as a process in shipbuilding, it may be fairly asked—if the Classification Societies permit the process on minor parts; if Lloyd's are prepared, subject to certain conditions, to classify an electrically-welded ship; if the British Admiralty has employed the process to a considerable extent; if the American railroads have used welding extensively on locomotives—why has not electric welding been adopted in American shipyards to a greater extent than it has been up to the present? The real reason, in the author's opinion, is that shipbuilders know that, at present, welds are lacking in uniformity, and it is not yet possible to tell when the welded joint is good or bad. Hence they hang back, and the author commends their wisdom.

How can this certainty that every joint will be efficient be ensured? While the electrical engineer and the metallurgist can assist the shipbuilder to solve this problem, there is much that he himself can do.

In the first place, he must realise the importance of employing only thoroughly skilled and experienced workmen, and he should call in the manufacturers of electric welding apparatus to assist him. The latter, for their own protection and the welfare of the industry on which they rely, should see to it that no ship should be allowed to be built with some of the thoroughly rotten work done by absolutely unskilled welders that the author has seen in the U.S.A. It is strongly urged that steps should be taken at once to establish welding as a skilled trade, and only certified men should be allowed to be employed. All the reports that have been seen on good and bad welds lay stress upon the fact that, in general, defects are mechanical, and not an inherent feature of the process. Skilled men working under an experienced foreman would know, for example, that clean surfaces were necessary for good work, they would quickly learn what types of joint were made with ease, in what portions of a ship welding was cheap, or where it was unreliable, and from their ranks should be drawn the draughtsmen who would design in detail the welded vessel of the future. The Electric Welding Committee of the U.S. Emergency Fleet Corporation has spent much time and thought on the attempt to discover a practicable non-destructive method of testing welds. While such a method of testing would be very valuable, it is the author's opinion that when only welders of proved skill are employed under experienced supervision, such tests will be no more necessary than a shear test on every rivet of a riveted ship; but so long as such welders are not available, the shipbuilder will look askance at a process that may be good generally, but may have weak spots of which he is ignorant.

Secondly, after he has trained a reliable staff of welders on work of minor importance, the shipbuilder must devote his attention to the best method of assembly of large parts, so that he may feel reasonably sure that every joint of the finished structure possesses the qualities which his welders can with certainty produce in test pieces. From the very outset it has been realised that this is a difficult problem which can be solved only by patient trial and experience. Present opinion at the British Admiralty is that the only satisfactory method is by the use of closing bolts as for riveted joints. In the case of the Richborough barge a certain amount of buckling resulted on the outboard edge of the garboard strakes after these plates had been welded to the keel plates, but this was removed when the bilge plates were put into position and bolted up. In the heavier work it may be that, buckling of plates being impossible, the internal stresses set up by the welding were the causes of the failures that occurred. It is understood that this method is being adopted at Cammell, Laird's, but, again, the plating of this vessel is not very heavy, and it is definitely known that this feature received most careful consideration from the very beginning. In the author's opinion this difficulty is by no means insuperable.

In the third place, it appears to be the fact that shipbuilding steel in Great Britain is more adapted to welding than shipbuilding steel in America, and the former is also more regular in its qualities. If shipbuilders are satisfied that such is the case, and are also convinced that electric welding has a great future in ship construction, they should take concerted action to ensure that steel producers supply the material best suited to their purpose.

A sound arc-welded joint is necessarily watertight, and once such a joint with known efficiency can be made with certainty, caulking is eliminated and the work of water-testing made easier. So far, the advantages anticipated in this direction have not been fully realised, but that they will be realised is only a matter of time, and it has already been fully demonstrated that welded joints, being stiffer, stand up better under test, and there is no breaking away of the caulk, such as is sometimes experienced with riveted connections under water pressure. Another advantage is a saving in steel due to the absence of rivet heads and the smaller width of laps and butt straps. The author at present is not a convert to the adoption of spot-welding for

heavy ship work; there are many difficulties ahead of those shipbuilders who attempt this form of welding, and until these difficulties have been fairly and squarely met he hesitates to affirm that spot-welding will be found a valuable process in ship construction.

In conclusion, the best line of approach appears to be to build up a staff of thoroughly skilled welders, to gain experience by the adoption of welding on minor parts, to proceed cautiously in the extension of the process to more important members, not to expect a great saving in time and cost immediately, but to persevere, not necessarily towards the rivetless ship, but towards a vessel in which the employment of both processes of riveting and welding is so adjusted that more riveting or more welding could only be done at greater cost.

ELECTRICITY SUPPLY PROGRESS IN WAR TIME.

(*Concluded from p.* 108.)

KEIGHLEY.

As all the largest works and mills in this district have received a high-tension supply since 1910, when the three-phase system was first installed, the bulk of the development during the war has been with the existing consumers putting in more plant, and running longer hours. In 1915 a 5,000-KW. set was ordered, and was eventually put into commission in May, 1917. This enabled the rapidly increasing load to be met without serious risk of a prolonged stoppage. The principal developments affecting the electricity department (Mr. H. Webber, electrical engineer and tramways general manager) have been the installation of a national shell factory, and a very big lighting demand created by a war hospital of considerable size. A number of small works have been connected to the mains, and towards the end of 1917 another shell factory took its power supply from the department. The units sold have increased from 4,324,572 in March, 1914, to 8,510,566 in March, 1918, *i.e.*, nearly double the output. The maximum demand has increased from 2,325 KW. in March, 1914, to 3,703 KW. in March, 1918.

With regard to mains work, an extra-high-tension line has been erected to the new Morton Banks war hospital, and about two and a half miles of underground high-tension cable has been laid. A big increase in the hire of small motors and considerable development in textile mills has taken place. A supply to Oakworth is about to be commenced in order to drive a mill requiring about 600 KW.; this will involve the erection of just over two miles of overhead transmission line. The boiler capacity being on the small side with the existing draught, an induced-draught plant was installed and put to work about the beginning of November. This enabled the most inferior grades of fuel to be burned efficiently. A supply to the outlying districts is contemplated in the near future.

BURTON-UPON-TRENT.

On account of the large demand for power purposes in the borough (Mr. Thos. Hall, electrical engineer and tramways manager) it was found necessary to proceed with extensions last year, consequently a 3,000-KW. turbine has been installed, together with two 25,000-lb. Babcock boilers, coal handling plant, storage bunkers, and ash removal plant. A new switchboard has also been erected on the remote control system, electrically operated, and several miles of H.T. main have been laid to supply consumers in different parts of the borough.

SMETHWICK.

The following brief particulars of extensions of electrical plant relate to the activities of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. (Mr. G. T. H. Legge, chief engineer). The amount of plant capacity of the undertaking when war broke out was 12,475 KW., while the amount of plant installed during the war at the Dudley and Smethwick stations, which two stations operate in parallel, is 24,250 KW. An old 400-KW. D.C. set at Dudley was removed, making the total to date 36,325 KW.

With reference to plant installed during the war, at the Dudley power station a 2,000-KW. Brush turbo-alternator and new E.H.T. switchgear by the British Thomson-Houston Co., Ltd., was installed, while at the Smethwick power station the additions to the plant comprised the following: Two 8,000-KW. B.T.H. turbo-alternators, each fitted with Willans twin condensers, and a 6,250-KW. B.T.H.-Dick, Kerr turbo-alternator set fitted with a Brush condenser. Ten new boilers were installed during the war; of the Babcock and Wilcox boilers, two were rated at 17,000 lb. per hour and six at 21,000 lb. per hour, while the remaining two are Clarke Chapman boilers, rated at 40,000 lb. per hour. Eight new Green's economisers were installed, and to deal with the cooling water, two Premier wooden natural-draught chimney cooling towers were erected, one of which is capable of dealing with 480,000 gallons and the other 334,000 gallons per hour. At Smethwick, coaling plant capable of dealing with 40 tons per hour was provided; this included bunkers of 3,000 tons capacity over the boilers, and new suction ash plant. The new E.H.T. switchboard is by the British Thomson-Houston Co., Ltd.

ELECTRIC WELDING.

The following are brief abstracts of three papers read before the Institution of Civil Engineers, on March 11th:—

"*Electric Welding Developments in Great Britain and the United States of America.*" By J. Caldwell and H. B. Sayers.

The retarded expansion of electric welding in the past is attributed mainly to the absence of clear understanding as to the essentials of the process and the lack of facilities to enable research investigation to be undertaken. Successful application is also dependent on the correct design and preparation of welded structures and the provision of sufficiently skilled operators. The three methods of electric welding are described, and their outstanding features are emphasised. With the resistance method the welding operation is rapid and efficient, besides being easily performed by unskilled labour, provided the machines are adjusted periodically. To enable repetition work to be undertaken at a higher rate of output, quick-releasing clamps and automatic switches are invariably fitted.

Special skill is required in manipulation with the carbon-arc process, by reason of the great heat generated at the arc, and welding by this means has therefore been largely confined to work of substantial size and thickness, although the authors point out that by observing certain necessary precautions, success has been achieved in applying the process to work of a general nature, particularly where speed is important.

Reference is made to the numerous stages of development through which the metal-arc process has passed since its inception, and particulars are submitted relating to the use of electrodes composed of covered and coated metal under various conditions of electric supply.

The second part of the paper deals with the general application of electric welding to various engineering and shipbuilding industries. Instances are cited of the efficiency and economy resulting from the use of electric welding in steam-railway practice, including relative data regarding repairs. The metal-electrode process is utilised almost entirely on this type of work, and with the recent improvements in this country of flux-covered electrodes, some of which are specially designed for welding high-tensile and alloy steels, the scope for electric welding plant in railway shops should be increased. The repair of cast-iron parts by the metal-electrode process is almost common practice in some locomotive repair-shops in America.

In munitions engineering works, resistance and metal-arc welding-processes have been employed to a large extent. Instances are given where the arc welding process is applied in aircraft work, and the authors advocate the adoption of the process for aeroplane construction to a much larger extent in the future.

Electric welding should benefit the automobile industry, especially in the easy assembly of steel bodies and in the repair of special steel parts with composite metal electrodes covered with suitable composition, by which means alloy and high-tensile steel can be successfully repaired and reinforced with metal having characteristics allied to those of the original material. Gear-wheels and gear-cases can be renovated, tanks and barrels manufactured, and caulking eliminated in riveted structures.

Two methods in the manufacture of tools are described, including the resistance welding of high-speed steel parts and the deposition of the cutting edges on mild-steel shanks with metal-arc welding.

In shipbuilding electric-arc welding has been proved practical as a substitute for forging, riveting, and caulking. Following the satisfactory conclusion of a series of tests, certain ship structures have been assembled either entirely or in part by this means, and examples are given where the process may be used to advantage in the construction of internal fittings and superstructures. As regards the possibility of joining ships' hulls by spot welding, information derived from recent experimental work indicates that spot welding of thick steel plates is capable of results equal in strength to riveting, with appreciable economy.

The remainder of the paper is devoted to a description of tests and experiments concerning the application of electric welding.

"*Experiments on the Application of Electric Welding to Large Structures.*" By W. S. Abell.

In this paper a full account is given of the comprehensive series of experiments recently carried out, on behalf of Lloyd's Register of Shipping, to determine the possibility of the application of electric-arc welding to ship-construction.

Information was sought regarding the physical properties of the welding and welded material, and its ability to withstand the alternating stresses to which vessels are subject.

The modulus of elasticity of the welded material was determined under several conditions, one series of observations being taken on test specimens, which were made as large as could be, with a view to approximating as closely as possible to conditions of actual service. It would appear that, in general, the extensions in way of the weld do not show any marked difference from those on the solid plate, the lines showing extensions in way of the weld lying among the others, without disclosing any distinctive features.

There is very little difference between the modulus of elasticity of the welded material and that of the solid plate.

Similar tests were also carried out on small test-pieces composed entirely of deposited metal, from which it appeared that the value of the modulus of elasticity of the material actually forming the weld was 11,700 tons per sq. in.

In the case of butt welds it was found that the tensile strength of the joints was 90 to 95 per cent. of that of the solid plate.

As the most common form of joint used in shipbuilding is the ordinary overlap, a complete series of tests was carried out on welded joints of this form. The tensile strength of the joint varied with the thickness of the plating, and was 65 to 85 per cent. of the strength of the solid plate in cases where a full fillet was fitted on both edges of the lap. The corresponding figures were practically the same in cases where a full fillet was fitted on one edge and a single run of weld on the other edge. In a comparative test the strength of a treble riveted lap joint with plates ¼ in. in thickness was found to be between 65 and 70 per cent. of the solid plate.

The ultimate elongation of a welded specimen in this series of tests was found to be only 8 per cent. on a length of 8 in., as against 29 per cent. for the solid plate, while the contractions of area were 7 per cent. and 45 per cent. respectively.

Special attention was paid to the determination of the properties of welded material under alternating stresses of known value. Two types of apparatus were employed in these tests, in one of which the specimens were in the form of bars, while in the other flat plates were used.

The bars were tested in pairs, one welded and one plain, at varying stresses, and from curves showing the results may be inferred that the highest stress at which the welded bars are able to withstand a very large number of repetitions of alternating stress is about 6 tons per sq. in., the corresponding figure in the case of the unwelded bars being about 10 tons per sq. in.

In the second form of apparatus the specimens were arranged in sets of four, namely, plain plate, butt weld, riveted joint, and lap weld.

The curves showing the results of these tests would appear to indicate that the stress at which the specimens with butt weld are able to endure a large number of alternations is about 70 per cent. of the stress borne by the similar plain plate, the corresponding figure for the comparative endurance of lap welds and riveted laps being about 60 per cent.

The results of the bending tests show that the welds do not compare very favourably as regards bending with ordinary mild steel, the angle at which fracture occurred varying from 80 deg. with ¼ in. plates down to 20 deg. with 1 in. plates.

To ascertain the capability of welded material to resist the shear stress induced during crushing, specimens having the weld at an angle of 45 deg. to their axis, together with corresponding unwelded samples, were tested under compression. Both welded and plain specimens yielded by bending before crushing took place, but the welded specimens withstood the comprehensive load as satisfactorily as the others.

"*The Application of Electric Welding in Ship Construction and Repairs.*" By J. R. Smith.

Descriptions and illustrations are given of typical repairs that have been successfully carried out under the author's supervision, and for which considerable economy in money and time is claimed, inasmuch as the necessity for renewals was obviated.

The success of this system has encouraged the idea of substituting it for the present method of riveting, and in any case marked economy of material would result from eliminating rivets to a large extent, if not entirely.

In experiments carried out by the author all the tests applied were for cross-bending and tensile stress, whereas he is of opinion that fatigue tests should also be made and examined.

The author points out that the secret of success in electric-arc welding being largely in the hands of the operator, very careful inspection is essential to good results and to progress in this new method of construction.

NATIONAL ELECTRICITY SUPPLY IN THE MIDLANDS.

Some months ago, when the Government first decided upon the national super-stations, the possibilities of the Midlands, and particularly the Black Country, were fully inquired into with a view to the erection of one of those stations in that great centre of the coal and iron trades. In fact, several representatives of public authorities were actually called into conference. The great argument in favour of the Black Country was the fact that all the coal likely to be required for many years was near at hand, and that nearly all the mines were water-logged, and could only be worked with the assistance of the Mines Drainage Commission. On examination, however, it was found that it would be cheaper to take the station to the river Severn at Stourport, and carry the coal, than to raise the water in the Black Country, and so the former scheme came to be adopted. It is more than probable, however, that a sub-station will be erected at Tipton, and this phase of the matter was discussed last week at a conference of colliery owners and experts held for the purpose of considering how to save the mines of the district, in view of the fact that the operations of the Commission will come to an end in a few years at most. It was pointed out by different speakers that the water would shortly be a valuable asset to the district, in view of the electrical schemes under discussion. It is estimated that in the Tipton district alone fifty-two tons of water are raised to every ton of coal, so that there would apparently be no deficiency of water. Meanwhile local authorities have been conferring as to what steps should be taken with regard to the future supply of electricity in the North-West Midlands, in view of the fact that they successfully opposed the Bill of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. A conference of local municipal authorities has passed the following resolution: "That this Conference agrees in principle to the setting up, as and when necessary, of a Joint Board for Electricity Supply for the area comprising the boroughs of Wolverhampton, Walsall, West Bromwich, Wednesbury, and the places now supplied by the Midland Electric Power Corporation, Ltd., together with the whole of the northern part of Staffordshire, particularly the borough of Stoke-on-Trent and the county of Salop, including Shrewsbury, or for such other area as may be shown to be the most economic area for the supply of electricity in the North-West Midlands, such Board to consist of representatives of the present undertakers, and that the engineers be empowered to prepare a draft scheme giving particulars and costs for the best and most economic method of generating, transmitting, and distributing electrical energy to meet the future requirements of such area." The various authorities are being requested to sanction the retention by this Board of consulting engineers.

IMPORT TRADE OF PERU.

The following statement, showing the imports of electrical and allied goods into Peru during the year 1917, is extracted from the recently-issued trade statistics. The figures for 1916 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1916. £	1917. £	Inc. or dec. £
Electrical apparatus.—			
From United States ...	1,500	5,000	+ 3,500
Copper wire and cable.—			
From United States ...	13,000	30,000	+ 17,000
,, Other countries ...	1,000	62,000*	+ 61,000
Total	14,000	92,000	+ 78,000
* Credited to Chile.			
Incandescent lamps.—			
From United States ...	7,000	13,000	+ 6,000
,, Great Britain ...	500	1,000	+ 500
,, Other countries	1,500	1,000	– 500
Total	9,000	15,000	+ 6,000
Pumps.—			
From United States ...	12,000	18,000	+ 6,000
,, Great Britain ...	2,000	2,000	—
,, Other countries ...	1,000	1,000	—
Total	15,000	21,000	+ 6,000
Boilers.—			
From Great Britain ...	10,000	6,000	– 4,000
,, United States ...	11,000	10,000	– 1,000
Total	21,000	16,000	– 5,000
Machinery (other than agricultural).—			
From Switzerland ...	2,000	6,000	+ 4,000
,, United States ...	72,000	273,000	+ 201,000
,, France	1,000	3,000	+ 2,000
,, Great Britain ...	14,000	19,000	+ 5,000
,, Other countries ...	2,000	2,000	—
Total	91,000	303,000	+ 212,000
Spare parts for machinery.—			
From United States ...	41,000	119,000	+ 78,000
,, Great Britain ...	15,000	13,000	– 2,000
,, Other countries ...	—	1,000	+ 1,000
Total	56,000	133,000	+ 77,000
Railway and tramway cars.—			
From Germany	27,000	47,000	+ 20,000
,, United States ...	2,000	2,000	—
Total	29,000	49,000	+ 20,000

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Simplex Heating and Cooling Fittings for Ships.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham, have recently issued a new booklet (No. 684—1/19), entitled "Electric Lighting and Heating for Ships," which is fully illustrated, and shows many of the special designs which the firm has carried out on some of the important Atlantic passenger liners. There is a good range of designs of indication lanterns, a type of fitting in which the firm has always specialised. Also shown are a good number of lighting fittings suitable for ships, from the small cabin to the elaborate saloon. The illustrations are all from photographs of actual fittings supplied for their special purpose.

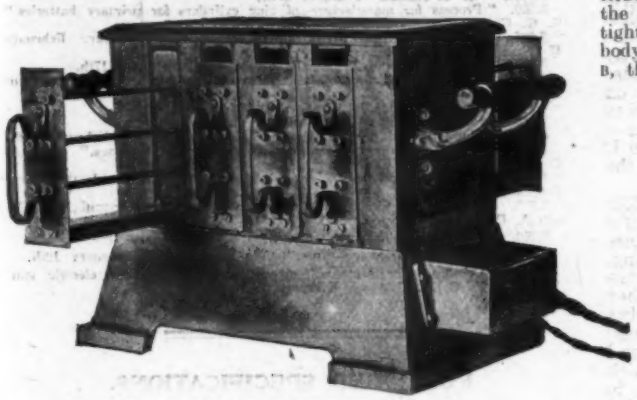

Fig. 1.—Multiple Electric Toaster.

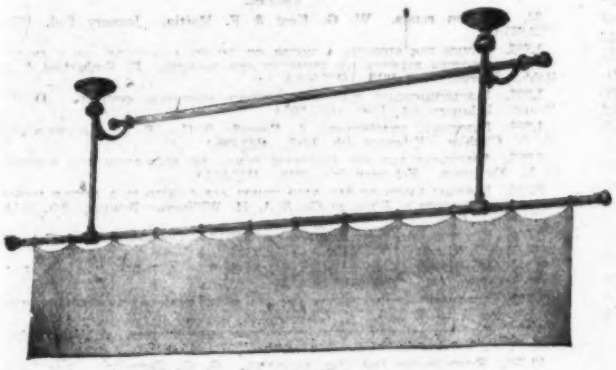

Fig. 2.—Simplex Punkah.

The "Plexsim" hot-bar fire is shown in a type specially designed for cabin use, while there are also designs of convector-type heaters of elaborate design for saloon use. The multiple electric toaster (fig. 1) is a business-like piece of apparatus, and must be exceedingly useful in a ship's galley. The last page is devoted to an illustration and description of the Simplex punkah (fig. 2), which makes use of electricity to replace the "Punkah Wallah." It is claimed that the solenoid and plunger arrangement (fig. 3) is a perfect imitation of the human pull: regular and rhythmic. It has the advantage of taking but little current, and as electricity neither sleeps nor neglects its duty, there should be a great future for the device in tropical countries.

An Electrically-Operated Gas Meter.

The Laclede Gas Light Co. in St. Louis, U.S.A., has recently installed a 750,000 cu. ft. per hour Thomas meter to measure the total gas manufactured in a station. The Thomas meter is different from all other forms of gas measuring devices, in that it records the cubic feet of gas per hour in the standard units of 30 in. of mercury and 60 deg. F., without any corrections for pressure and temperature. Further, it records this measure on a graphic chart which shows the amount and variation of the gas flow, and on an integrating instrument which shows the total gas during any given period. The measurement of the gas is accomplished by warming it 2 deg. with an electric heater as it flows through the meter, and measuring accurately the electric power required to do this. This quantity constitutes a measure of the rate of flow of gas in standard cubic feet regardless of the existing pressure, temperature, or volume of the gas. Current is regulated by two electrical thermometers. The equipment was furnished by the Cutler-Hammer Manufacturing Co., of Milwaukee.—*Journal of Electricity.*

The Swarren Conduit Coupling.

The accompanying illustrations show the construction of a new coupling for conduit, introduced by Messrs. Swarren, Ltd., of 52 & 54, Theobald's Road, W.C.1, to dispense with the necessity of screwing the conduit and yet ensure watertightness and metallic continuity. In fig. 4 A is the main body of the coupling, showing the abutments against which B, the highly ductile metallic sealing members, are pressed by the nuts or tightening members C. The tightening of those nuts causes the said member to seal the joints between the inner surface of the body of the coupling shown at D, and the outer surface of the conduit shown at E.

Fig. 3.—Solenoid and Plunger.

This coupling has also been made with quite satisfactory results with the tightening member non-screwed, merely being a sliding fit within the main body of the coupling; in this case the nut is tightened by simply applying pressure to the outer faces of the tightening members by means of a pair of tongs or the like, the pressure being applied (in the case of ironclad fittings) to the face of the nut shown at G, and the internal surface of the ironclad box shown at H, in fig. 4. When joining two conduits, the tongs would be applied so as simultaneously to press upon the two opposite nuts shown at F and I in fig. 5. The makers have designed a simple tool to use in all these non-screwed cases, with which elbows and all other fittings can be conveniently tightened. Negotiations are in progress with leading manufacturers, who are now making a number of fittings, and Messrs. Swarren will be in a position at an early date to quote for this device in every size and form.

It will be seen that when this coupling is used there is no need to adjust the lengths of the conduits accurately, as when, for instance, a number of tubes are brought down to a fuse box; the variations in length are taken up in the couplings, thus saving a good deal of fiddling work, and ensuring a tidy finish. Moreover the wires can be threaded through the tubes in the first instance, as the couplings can be applied without rotating the tubes or taking them down for screwing.

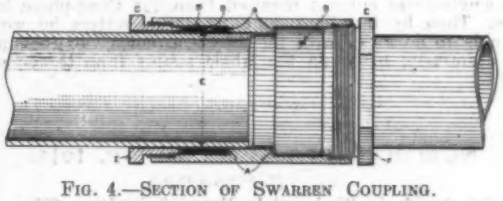

Fig. 4.—Section of Swarren Coupling.

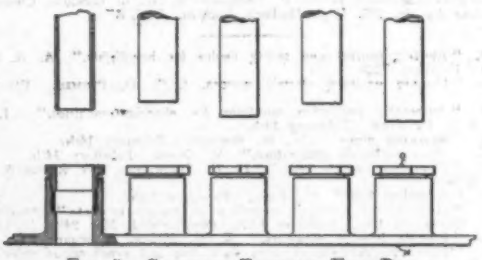

Fig. 5.—Conduits Entering Fuse-Box.

THE SUPPLY OF SINGLE-PHASE POWER FROM THREE-PHASE SYSTEMS.

Mr. H. S. Ellis, M.I.E.E., borough electrical engineer, South Shields, writes to point out that the brief report on page 250 of our last issue of his observations on Professor Miles Walker's paper was misleading. It might appear from our report that he had attempted to obtain single-phase current and three-phase current from the same machine at the same time, and that as a result the machine had had to be re-wound. This is entirely wrong; he never attempted to do this, and, furthermore, when the machine referred to was rewound, the work was carried out with the sole object of making this particular machine exactly similar to the two three-phase machines more recently installed. Fortunately, when the original single-phase machine was supplied in 1912, it was supplied with a three-phase stator wound to give single-phase only, and there were a number of empty slots in this stator. Consequently it was only necessary to have these slots filled up and the windings arranged in an exactly similar manner to those of the other two three-phase machines. His three-phase alternators have worked on single-phase, or three-phase loads with entirely satisfactory results during the past four years. When running as a single-phase machine, one winding is left idle, one phase is earthed, and the other phase is connected to the inner of the high-tension, single- phase supply.

In the discussion on Prof. Miles Walker's paper, Mr. Ellis said he had been engaged upon the problem of obtaining a satisfactory supply of single-phase current from three-phase generators for general supply purposes, *i.e.*, lighting, heating, power, &c., in which case it was of the utmost importance to ensure a perfectly steady voltage. At South Shields they had, until about four years ago, two distinct systems, namely: single-phase (50 cycles) with transformer sub-station, where the bus-bar pressure of 2,100 volts was reduced to 220 and 110 volts; and a direct current system at 550 volts, which was used for traction and power purposes. In addition to the reciprocating plant there was installed a turbo-generator (1,500 R.P.M.) consisting of a 1,500-KW. turbine, a 1,000-KW., D.C. generator, and a 1,000-KW., single-phase alternator in tandem. In 1914, owing to the increasing demands for current for power purposes, he considered the question of installing a second set such as that just described, but after careful consideration, he decided that the future requirements of the area called for a supply of three-phase current. Consequently a 2,000-KW. turbine (3,000 R.P.M.) coupled to two 1,500-KW. alternators (2,100 volts) in tandem was installed together with rotary converters. The alternators were specially designed to be capable of generating 1,500 KW., three-phase, or 1,200 KW., single- phase. The set was therefore suitable for supplying three entirely separate systems, *i.e.*, three-phase, single-phase, and (through the rotaries) direct current.

The 1,000-KW. alternator (1,500 R.P.M.) had recently been rewound, and made exactly similar to the two alternators just described, and the capacity of the turbine had been increased by 500 KW. by adding new nozzle blocks and a new first diaphragm. All the alternators could be run in parallel either as three-phase or single-phase machines.

There were now three distinct sets of bus-bars in the station, consequently three types of generators had to be kept going. He was aiming at having one system of generation only in the future, namely, three-phase, but as it would take some time to accomplish this, he now proposed to install "Scott-connected" transformers, so that he would be able in future to do away with the single-phase generators, and obtain all the single-phase current required from the three-phase bus-bars. Then by installing more rotary converters he would be able to do away with the direct-current generators, and so, ultimately, to obtain the whole supply from three-phase plant.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

3,649. "Electric control and safety device for headlights." A. B. Ashworth. February 14th.
3,650. "Cooling enclosed electric motors, &c." D. Penman. February 14th.
3,654. "Automatic excitation regulator for electric machines." J. T. Irwin & A. Rushton. February 14th.
3,664. "Sparking plugs." W. W. Simpson. February 14th.
3,665. "Dynamo-electric generators." V. Crabb. February 14th.
3,676. "Electrical storage cells." H. C. Smith and Van Raden & Co. February 14th.
3,680. "Electrical bell." M. Rose. February 14th.
3,683. "High-voltage windings embedded in grooves or slots." Akt. Ges. Brown, Boveri et Cie. February 14th. (Switzerland, May 24th, 1918.)
3,684. "Electric heating elements." R. K. Hearn. February 14th.
3,692. "Electromagnetic step-by-step signalling and synchronous rotation." C. L. Walker. February 14th.
3,693. "Electric furnaces." W. E. Moore. February 14th.
3,701. "Electric locomotives." G. Pestarini. February 14th. (Italy, February 14th, 1918.)
3,702. "Devices for controlling flow of electrons." E. Berry & Marconi's Wireless Telegraph Co. February 14th.
3,711. "Lamp telephone relays." M. Latour. February 14th. (France, February 14th, 1918.)
3,712. "High-frequency generators." E. Girardeau. February 14th. (France, February 14th, 1918.)
3,724. "Apparatus for controlling supply of electric energy." M. Anniss-ger. February 14th.
3,725. "Friction-drive mechanism for electric generators." L. Rosengart. February 14th. (France, December 31st, 1918.)
3,753. "Devices for indicating position of electric switches, gas fittings, &c." J. E. Arnold. February 15th.
3,761. "Attachment to trolley of overhead electric trams, &c., for facilitating replacement of trolley on the wire." T. Forsyth. February 15th.
3,760. "Sparking plugs." D. Anderson. February 15th.
3,768. "Mounting sparking plugs in position on engines." H. E. Brodrick & J. F. Joyce. February 15th.
3,789. "Operating electric switches from a distance." A. H. Francks, and Telephos Domestic & Street Lighting Co. February 15th.
3,794. "Electric reading lamp attachable to cover of a book." G. H. Marsh. February 15th.
3,808. "Sparking plugs." V. Bonde. February 15th.
3,828. "Dowel for attaching electric-bell covers, box lids, &c." A. E. B. Lloyd & F. E. Wallis. February 17th.
3,835. "Methods of using three-electrode ionic tubes." L. B. Turner. February 17th.
3,847. "Device to protect controller and motors on electrically-propelled vehicles." G. C. Adams. February 17th.
3,860. "Process for manufacture of zinc cylinders for primary batteries." S. O. Cowper-Coles. February 17th.
3,883. "Electric and gas ovens, stoves, &c." H. H. Berry. February 17th.
3,887. "Electric switches." M. E. Callegaris. February 17th.
3,888. "Automatic indicator of failing current." Synchronome Co. February 17th.
3,931. "Sparking plugs." W. G. Ikin. February 17th.
3,942. "Sparking plugs." H. Taylor. February 18th.
3,956. "Magnetic and galvanic buttons." A. H. Simpson. February 18th.
3,968. "Sound reproducers for gramophones and telephones." R. A. Disdin, G. H. Glover & Resonance, Ltd. February 18th.
3,977. "Electrical cut-outs or circuit-breakers." W. H. Illingworth. February 18th.
3,990. "Automatic cut-in and cut-out switches." Fuller Accumulator Co. and A. P. Welch. February 18th.
3,993. "Automatic telephones." A. E. Jones. February 18th.
4,029. "Thermo-electric apparatus." W. H. Wilson. February 18th.
4,057. "Couplings for armoured or protective cables and electric conductors." V. C. H. Gibson. February 18th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

34. Sparking plugs. W. G. Kent & F. Martin. January 2nd, 1918. (122,865.)
1,865. Device for stopping a motor or giving a warning when an obstruction occurs between its armature and magnets. P. Rutherford & J. Robb. February 1st, 1918. (122,876.)
1,903. Electromagnetic clutches without frictional contact. D. C. Henry. February 1st, 1918. (122,880.)
1,988. Electrical switchgear. A. Revrolle & Co., R. M. Longman and H. W. Clothier. February 4th, 1918. (122,885.)
2,085. Adjustable electric reactance coils for split-conductor systems. J. L. Thompson. February 5th, 1918. (122,893.)
2,349. Electric lamps of the kind which are carried by a handle which projects therefrom. Efandem Co. & A. H. Williams. February 9th, 1918. (122,914.)
2,664. Electric motor-control systems. British Thomson-Houston Co. and J. J. Ash. February 14th, 1918. (122,926.)
3,014. Mine and like electric bells. J. B. Eder & British Agencies, Ltd. February 20th, 1918. (122,931.)
3,330. Automatic apparatus for shaking snow from electric conductors. V. Cicari. April 30th, 1917. (115,417.)
6,918. Electric starters for internal-combustion engines. A. H. Midgley and C. A. Vandervell & Co. April 24th, 1918. (122,973.)
10,309. Rontgen-ray and like apparatus. G. G. Campion. June 22nd, 1918. (122,780.)
10,099. Telegraph systems. Automatic Telephone Manufacturing Co., H. H. Harrison & S. R. Smith. June 19th, 1918 (121,914.)
10,406. Electric contact breakers or interrupters. G. F. Cooke. June 25th, 1918. (122,580.)
11,043. Electrical fuses. R. A. R. Bolton. July 5th, 1918. (122,360.)
12,306. Non-accumulatic electric signalling indicator for colliery shafts and the like. H. Brown & J. H. Evans. July 29th, 1918. (122,136.)
12,367. Electric time transmitters or master clocks. J. J. Liverton. July 30th, 1918. (122,592.)
12,839. Distributors for use in ignition magnetos. A. Anzani. August 7th, 1917. (120,714.)
12,949. Automatic telephone systems. Automatic Telephone Manufacturing Co. September 19th, 1917. (119,449.)
12,959. Dynamo-electric machines. J. H. St. H. Mawdsley. August 9th, 1918. (122,141.)
13,988. Lampholders of the Edison type. A. Piazzi. August 28th, 1917. (118,637.)
14,154. Controlling switches of combined ammeters and voltmeters used in connection with dynamo-lighting and battery-charging systems of motor vehicles and the like. W. Holt & B. Brooks. August 31st, 1918. (122,797.)
14,148. Electric lampholders. August 31st, 1918. W. L. Bodman. (122,000.)
14,372. Means for improving the conductivity at the joints of electrodes for electric furnaces. C. W. Kayser & D. W. MacDonald. September 4th, 1918. (123,017.)
15,124. Energy meters for alternating electric current. Fabrique des Longines Francillon & Co. September 17th, 1917. (119,657.)
15,250. Welding joints. British Thomson-Houston Co. (General Electric Co., U.S.A.) September 19th, 1918. (122,604.)
15,587. Electrodes or plates for electric accumulators of the alkaline type. W. N. Stewart. September 25th, 1918. (122,380.)
15,869. Electric welding apparatus. British Thomson-Houston Co. (General Electric Co., U.S.A.) September 30th, 1918. (122,606.)
16,289. Electric regulating resistances. E. A. E. Tornblom. October 8th, 1917. (119,872.)
17,222. Electric coupling. E. Pagnon. October 22nd, 1918. (123,032.)
17,641. Motor power plant. British Westinghouse Electric & Manufacturing Co. November 21st, 1917. (120,889.)
20,784. Electrical phase-converting systems. British Westinghouse Electric & Manufacturing Co. December 13th, 1917. (121,487.)
20,069. Sparking plugs. A. E. Lamkin. December 4th, 1918. (122,617.)
21,592. Sparking plug for explosion engines. E. Ruillet & R. Hureau. December 26th, 1917. (121,953.)